

ANNALS
OF THE
SOUTH AFRICAN MUSEUM

VOLUME XX.

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PRINTED FOR THE
TRUSTEES OF THE SOUTH AFRICAN MUSEUM
BY NEILL AND CO., LTD., 212 CAUSEWAYSIDE, EDINBURGH.
1924-1926.

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LIST OF CONTRIBUTORS.

K. H. BARNARD.	PAGE
Contributions to the Crustacean Fauna of South Africa. No. 7.	
Cirripedia.	1
Contributions to a Knowledge of the Fauna of South-West Africa.	
2. Crustacea Entomostraca, Phyllopoda	213
Contributions to a Knowledge of the Fauna of South-West Africa.	
3. Crustacea Isopoda Terrestria	231
Contributions to the Crustacean Fauna of South Africa. No. 8. Further	
Additions to the List of Amphipoda	319
Contributions to the Crustacean Fauna of South Africa. No. 9. Further	
Additions to the List of Isopoda	381
H. L. CLARK.	
A New Clypeaster from Angola	317
J. HEWITT.	
Descriptions of New and Little-known Lizards and Batrachians from	
South Africa	413
Some New or Little-known Reptiles and Batrachians from South Africa	473
J. H. POWER.	
A Monographic Revision of the Genus <i>Breviceps</i> , with Distribution	
Records and Descriptions of New Species	451
W. ROSE.	
Some Field Notes on the Batrachia of the Cape Peninsula	433
Some Notes on the Lizards of the Cape Peninsula	491
G. O. SAERS.	
The Fresh-water Entomostraca of the Cape Province (Union of South	
Africa). Part 2. Ostracoda	105
Contributions to a Knowledge of the Fauna of South-West Africa.	
1. Crustacea Entomostraca, Ostracoda	195
J. R. LE B. TOMLIN.	
Reports on the Marine Mollusca in the Collections of the South African	
Museum. 1. Turritellidae	309
H. WATSON.	
The South African Species of the Molluscan Genus <i>Onchidella</i>	237

INDEX OF NEW GENERIC NAMES INTRODUCED IN THIS VOLUME.

	PAGE
Aegoniscus (Cabiropsidae), BARNARD	409
Afrocypris (Cypridae), SARS	206
Arthroleptella (Ranidae), HEWITT	426
Austrosyrrhoë (Tironidae), BARNARD	354
Bradycypris (Cypridae), SARS	145
Cyprilla (Cypridae), SARS	169
Exampithoe (Ampithoidae), BARNARD	363
Gomphocythere (Cytheridae), SARS	174
Homocypris (Cypridae), SARS	119
Liocypris (Cypridae), SARS	114
Microbatrachus (Engystomatidae), HEWITT	420
Paracyprretta (Cypridae), SARS	152
Phoxostoma (Lysiannasidae), BARNARD	323
Pseudojanira (Jaeridae), BARNARD	406
Scleroocypris (Cypridae), SARS	131

DATE OF ISSUE OF PARTS.

- Part 1, April 1924.
- Part 2, August 1924.
- Part 3, November 1924.
- Part 4, March 1925.
- Part 5, December 1925.
- Part 6, July 1926.

LIST OF PLATES.

PLATES.	
I.	South African Cirripedia.
II-XX.	South African Entomostraca.
XXI-XXV.	South-West African Ostracoda.
XXVI.	South-West African Phyllopoda.
XXVII-XXXI.	Anatomy of <i>Onchidella</i> .
XXXII.	Map of distribution of <i>Onchidella</i> .
XXXIII.	<i>Clypeaster micropetalus</i> , n. sp.
XXXIV.	South African Amphipod Crustacea.
XXXV.	<i>Rhoptropus barnardi</i> , n. sp.
XXXVI.	South African Batrachia.
XXXVII.	<i>Bufo rosei</i> , n. sp.
XXXVIII.	South African Batrachia.
XXXIX-XLIII.	The genus <i>Breviceps</i> .
XLIV-XLV.	South African Lacertilia.

INDEX OF GENERA.

xi

xiii

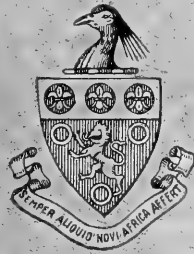
T					V				
				PAGE					PAGE
Tesseropora	.	.	.	91	Vibilia	.	.	.	375
Tetracita	.	.	.	90					
Tetradactylus	.	.	.	417, 493					
Trischizostoma	.	.	.	320					
Tropidosaura	.	.	.	485, 493	X				
Tubicinella	.	.	.	95	Xenobalanus	.	.	.	96
Turritella	.	.	.	309	Xenocalamus	.	.	.	473
Tylos	.	.	.	236	Xenopus	.	.	.	443
					Z				
					Zonocypris	.	.	.	150
U					Zonurus	.	.	.	492
Uristes	.	.	.	333					

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PART I. containing—

- 1.—*Contributions to the Crustacean Fauna of South Africa.*
By K. H. BARNARD, M.A., F.L.S., Assistant Director.
(Plate I.)



ISSUED APRIL 1924. PRICE 8s. 6d.

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1. *Contributions to the Crustacean Fauna of South Africa.*—By K. H. BARNARD, M.A., F.L.S., Assistant Director.

No. 7. CIRRIPIEDIA.

(With Plate I.)

THE collection of barnacles in the South African Museum is derived almost entirely from the investigations of the Cape Government trawler “Pieter Faure.” It consists, therefore, with few exceptions, of material from shallow and moderately deep water and not from the littoral zone. Collectors seem to have paid little attention to the littoral barnacles of this region.

In Stebbing’s 1910 Catalogue of South African Crustacea 26 species of barnacles—10 stalked, 15 sessile, and 1 other—are recorded. The present report brings the number up to 74—40 stalked, 32 sessile, and 2 others. The greatest increase is thus in the stalked barnacles, and especially in the family *Scalpellidae*. Of this family only 2 species were formerly known to inhabit these waters as against 20 now recorded.

The family *Verrucidae*, however, still remains unrepresented: which seems not a little remarkable.

With regard to the *Scalpellidae*, there appears to be a local or indigenous fauna consisting of species distinct from, though often closely allied to, species living in other seas. On the other hand, a few species previously known from the North Atlantic or Indo-Pacific oceans have been rediscovered here.

But the most interesting result of the examination of the members of this family, strictly speaking of the genus *Scalpellum*, is the proof

that in over half the South African species there is *no free-swimming* larval stage as is so characteristic in nearly all other Cirripedes. A general summary of these results together with a review of the previous literature is given in the first part of this paper.*

In the second part the collection is dealt with systematically. Species recorded from these waters but not represented in the collection are inserted in their proper places.

The keys in the present paper are not intended to express the natural relationships, but merely to form a convenient means of identification. In drawing them up I have availed myself of the works of Pilsbry and others, modifying and adapting only where necessary.

As well as a general acknowledgment of indebtedness to other workers, my thanks are especially due to Dr. Pilsbry and Dr. Annandale for sending me copies of their papers, some of which would otherwise have been inaccessible to me.

I. THE LARVAL STAGES IN THE GENUS *SCALPELLUM*.

On the larval stages in this genus, which is taken *sensu stricto*, and does not include *Smilium* or *Calantica*, the only papers to which reference need be made are the following :—

- (1) 1851 and 1854. Darwin, Monogr. Cirrip. : (i) Lepadidae, (ii) Balanidae.
- (2) 1883. Hoek, Challenger Rep., vol. viii.
- (3) 1884. Hoek, Challenger Rep., vol. x.
- (4) 1894. Aurivillius, Studien über Cirrip. K. Sv. Vet. Ak. Handl., vol. xxvi, No. 7.
- (5) 1899. Hansen, Cladoc. and Cirrip., Plankton Exp., vol. ii.
- (6) 1907. Hoek, Siboga Exp. Monogr., 31a. Cirrip. Pedunculata.

(1) Darwin (i, p. 9 ; ii, p. 103, pl. xxix, fig. 8) has described and figured a larva of *S. vulgare* in the first stage "immediately after coming out of the egg." It is a *Nauplius* larva, the later development of which was unknown to Darwin. Nor, so far as I am aware, has the life-history of this species since been worked out. Darwin also noted (i, p. 221) the remarkably large size of the ova in this genus.

After the publication of Darwin's Monograph the investigations of Claus and others placed our knowledge of the life-histories of the

* It is as well to state that this MSS. was completed in 1916. I have left my remarks on the larval stages as originally written, merely adding an extra paragraph correlating my results with those of Nilsson-Cantell published in 1921.

Cirripedia on a firm basis. And it seemed to be assumed that all the members of the group agreed with the types examined in possessing a free-swimming *Nauplius* stage.

(2) In 1883, however, while studying the collections made by H.M.S. "Challenger," Hoek made the interesting discovery that a specimen of *S. stroemii* from 516 fathoms contained larvae which had already reached the *Cypris*-stage in the mantle cavity of the ♀ (p. 75, pl. viii, fig. 1). This larva is in a very early *Cypris*-stage, and might almost be termed a *Metanauplius*, except that the cirri and caudal appendages are already developed, which is not the case, at least not to such a degree, in the typical *Metanauplius*. The "exuviae of the *Nauplius*" I regard as the egg-membrane or chorion. Hoek also noted the comparatively small number and the large size of the embryos.

Further, it is stated under *S. triangulare* that "among the eggs, which entirely fill the cavity of the capitulum," a larva in the *Cypris*-stage was observed. This evidence is not adduced in support of the remarks made under *S. stroemii*.

(3) The same author, while dealing with the "Challenger" collection from an anatomical point of view, refers to the *Cypris*-larva of *S. triangulare* (p. 8, pl. ii, fig. 4), and says: "I think it is in this stage that the *Cypris*-larva leaves the mantle cavity of the mother." This remark stands entirely by itself, again with no reference to the discovery of *Cypris*-larvae in *S. stroemii*. Yet in itself it implies that development without a free-swimming stage is the normal course, and well known to students of Cirripedes.

(4) In 1894 Aurivillius published an important paper in which, besides describing the species, he paid particular attention to the post-embryonic development in the deep-sea species, comparing it with that of shallow-water or pelagic species. He does not refer to Hoek's observations.

The results of Aurivillius' studies were as follows:—

S. septentrionale Auriv. (p. 52). Examples from 600–675 metres contained "numerous" embryos in the "first post-embryonic stage," similar to those found in:—

S. erosum Auriv. (p. 54, pl. ix, fig. 5) from 1744 metres. Here also "numerous" embryos were found which, from the figure and description, exactly resemble the embryos found by Hoek in *stroemii*. This larva corresponds with the *Metanauplius* stage, with 4 anterior pairs of appendages, but has in addition the beginnings of the cirri and caudal appendages.

S. obesum Auriv. (p. 57, pl. ix, fig. 6) from 110 metres. In this case the fully developed *Cypris*-stage was found.

S. cornutum Sars. (Auriv., p. 62) from 46–90 metres. *Cypris*-larvae as in *obesum*.

S. prunulum Auriv. (p. 63) from 350–600 metres. *Cypris*-larvae as in *obesum*.

Aurivillius sees in this cutting-out of a free-swimming *Nauplius* stage an adaptation to “deep-water” conditions. His own facts, however, scarcely support this. While it is true that the 1st, 2nd, and 5th species may be termed “deep-water” inhabitants, *obesum* and *cornutum* certainly cannot. Nor is there any great difference between 46 metres, at which *cornutum* was found, and 30 metres, at which *vulgare* is stated to be found. Yet Aurivillius has contrasted (p. 55) the life-history of this latter species, possessing, according to him, a free-swimming stage, with that of the “deep-water” species without a free-swimming stage.

(5) These discoveries of Hoek and Aurivillius seem to have evoked little interest. In Gruvel's Monograph (1905) I can find not even a passing reference to the fact that an abbreviated life-history had been discovered in certain species of *Scalpellum*. They were, however, noticed in a footnote by Hansen, an author who is always careful with regard to the earlier literature of his subject, in his report on the Cirripedes of the Plankton Expedition (p. 16).

(6) The only other reference to an abbreviated life-history, of which I am aware, is that made by Hoek in 1907. Here also it is remarkable that, although Hoek has seen the provisional descriptions (in 1892) of the species described by Aurivillius, he seems quite ignorant of the 1894 paper. He merely refers to his original observation in the Challenger Report (1883), and remarks that “from that discovery” there can be no doubt that “there are *Scalpellums* which develop without a free-swimming *Nauplius* stage,” and that these are “deep-sea species” (p. 73).

From a study of a specimen of *S. stearnsi*, var. *robusta*, he further adduces evidence that not only the ♂ but the ♀ also develops in this manner. But no *Cypris*-larvae were found actually within the capitulum of the large ♀. Figures are given of a young animal creeping out of the *Cypris*-shell and of one recently attached.

The only remark I have to make on this is that the young animal probably does not creep out of the *Cypris*-shell, but attaches itself while still within the shell. My reasons for this are: firstly, the (by no means conclusive) one of analogy with *S. valvulifer* and

eumitos (pp. 19, 36, *infra*), as well as with the known facts of the life-history of *Lapes* and *Balanus*; secondly, that Hoek's fig. 10 on pl. vi shows no antennae or indication of attachment, and that the figure gives the impression not of a young animal *creeping out* of the *Cypris*-shell but of a *Cypris*-larva *expelled from* its shell by convulsive movements due to the action of the preservative fluid. In support of this it is to be noted also that no indications of the primordial valves are represented except that of the tergum.

I do not wish to imply that an exactly similar mode of growth occurs in every species of the genus; only to accentuate the necessity of further observations on this point by contrasting Hoek's statements with what occurs in the South African species *valvulifer* and *eumitos*. Here the *Cypris*-shell is not cast off until the animal is fixed and the primordial valves of the terga, scuta, and carina are developed.

In two of the *Siboga* species Hoek has found ova: 17 in *sessile* (p. 90), measuring $\cdot 47 \times \cdot 27$ mm., and 53 in *gracile* (p. 107), measuring $\cdot 5 \times \cdot 33$ mm.

Thus from the studies of Hoek and Aurivillius we now know 7 members of the genus, namely: *stroemii*, *triangulare*, *septentrionale*, *erosum*, *obesum*, *cornutum*, *prunulum*, and possibly also *stearnsi*, which develop from the egg up to the *Cypris*-stage within the capitulum of the mother. The evidence is not complete or direct in every case, but the doubtful cases become almost certainties by analogy when we turn to the evidence derived from the "Pieter Faure" collection.

Summarising the results detailed under each species in the Systematic part of this paper, we find that there are 17 species in the South African fauna (*rutilum* is excluded as it is not contained in the collection), in 12 of which the *Cypris*-larva has been found within the ♀ capitulum. In one other species the larvae were in an early *Metanauplius* stage. In two species only the ova were found and two others were nonovigerous.

The following list gives the species with their bathymetrical range and the latest larval stage which was found within the mantle cavity. Where no ova or larvae were found both columns are left blank.

1. <i>valvulifer</i> Annand	.	.	.	22-87 fathoms.	<i>Cypris</i> .
2. <i>ornatum</i> (Gray)	.	.	.	36-85 „	„
3. <i>faurei</i> n. sp.	.	.	.	70-95 „	„
4. <i>cancellatum</i> n. sp.	.	.	.	200-250 „	„
5. <i>subalatum</i> n. sp.	.	.	.	51-200 „	„
6. <i>capense</i> n. sp.	.	.	.	95-136 „	„
7. <i>agulhense</i> n. sp.	.	.	.	250-256 „	Ova.

8. <i>brachium-cancri</i> Welt.	.	.	105	fathoms.	Cypris.
9. <i>porcellanum</i> n. sp.	.	.	.	..	..
10. <i>brevicaulis</i> n. sp.	.	.	36	fathoms.	Cypris.
11. <i>eumitos</i> n. sp.	.	.	51-230	„	„
12. <i>uncinatum</i> n. sp.	.	.	36-92	„	„
13. <i>natalense</i> n. sp.	.	.	79	„	„
14. <i>sinuatum</i> Pilsbry	.	.	800-1000	„	Ova.
15. <i>botellinae</i> n. sp.	.	.	47-54	„	Cypris.
16. <i>micrum</i> Pilsbry	.	.	400-450	„	Early Metanauplius.
17. <i>imperfectum</i> Pilsbry	.	.	.	..	..

Firstly, this list shows that there is no difference in the life-history of shallow- and deep-water species. *Cypris*-larvae are found in e.g. *valvulifer* from 22 fathoms as well as in *cancellatum* from 250 fathoms.

Secondly, from a study of the whole material it was found that the number of ova or embryos was always very small, compared with the vast number produced by the *Lepadidae*. This number never exceeded 45. Aurivillius' term, "numerous," may well be taken to mean 50 or thereabouts. Hoek records 53 ova in *gracile*. The smallest numbers I have found were 8 in *brevicaulis* and 9 in *botellinae*. In the latter case they were fully developed *Cypris*-larvae, so that some may have already escaped, although I think the more likely explanation is that the larvae are so large compared with the mother that a greater number could not be accommodated. In the case of *brevicaulis* the *Cypris*-larvae are not quite fully developed, nor are they so large proportionately as in *botellinae*, so that the question arises whether all the members of a brood develop equally fast or whether some get ahead of their fellows and pass out of the mother. The latter occurs in *ornatum*; but no evidence of a similar occurrence in *valvulifer* could be found.

Thirdly, the ova are very much larger than those produced by the *Lepadidae*, as noted by Darwin in *vulgare*.

There seems to be no particular breeding season, specimens containing *Cypris*-larvae having been collected in nearly every month. This applies collectively; the material not being extensive enough to determine whether particular *species* breed at certain definite times of year.

The present collection, as stated above, has enabled me to prove the presence of a *Cypris*-larva within the capitulum in 12 out of 17 species inhabiting these waters, *i.e.* 70 per cent. If one includes also those species in which ova or *Metanauplii* were found, on the grounds of large size and small number, the percentage rises to 88.2. These results are entirely due to the fact that the "Pieter Faure" worked

over more or less the same ground month after month for several years. It shows the value of such methods in the investigation of a marine fauna.

It is, therefore, not a little surprising that Aurivillius found the *Cypris*-stage in 3 and the *Metanauplius* in 2 out of the 12 species of *Scalpellum* s. str. which he studied. And this material was collected by various collectors, at various times, and in widely separated localities. It suggests that the collections in other museums are well worth examining with regard to this particular point.

Thus it seems almost incredible that out of some 80 specimens, belonging to 35 species, the 2 discovered by Hoek are the only ones containing ova or larvae. Yet, since Hoek examined the internal anatomy in those cases where he had more than one specimen of the species, we must regard it as a mere chance that he found ova in only two cases.

Where a species was represented by only a single specimen, Hoek was actuated by the perfectly intelligible motive of not wishing to spoil the specimen. I submit, however, that this is a wrong principle in scientific investigation, especially where much information can be gained without in reality damaging the specimen. In the particular case of the pedunculate barnacles the whole of the animal within the capitulum, the male and the ova, or embryos, if any, can be extracted by merely removing the scutum from one side. As the whole of the other side is left intact and the capitulum is not removed from the peduncle, I cannot see that such a specimen is irretrievably damaged or has been "sacrificed" to investigation. In the course of the present study, when the *Cypris*-larva was found in the first specimen opened I have not opened any others in order to find other stages. In other cases it was necessary to open several or even all the specimens before one containing *Cypris*-larvae was found.

Of the life-histories of the species discovered by other expeditions also we are ignorant. In fact, out of more than 200 species comprising the genus, we know the life-history of scarcely two dozen, including the South African species. And in the case of some of these, we must remember there is no absolutely direct proof that the free-swimming stage is omitted; they are included on grounds of analogy on account of containing a small number of rather large ova.

Nevertheless, from the study of the South African collection, I think there is very strong presumptive evidence that in the majority, at least, of the species in this genus development takes place within the capitulum of the ♀ up to the *Cypris*-stage.

As noted at the beginning, the genus *Smilium* does not come within the scope of this discussion. It may, however, be mentioned that in *S. pollicipedoides* a coherent mass of numerous and relatively small eggs is found, and in *S. squamuliferum* Annandale has recorded that the eggs cohere together into a mass which is held in position by two dorsal processes analogous to the ovigerous frena in the *Lepadidae* (1906, in Herdman's Ceylon Pearl Fish. Suppl. Rep., 31, p. 142; and Illustrations Zool., "Investigator," 1906, pl. ii, fig. 4). Thus in all probability the life-history in this genus includes a free-swimming stage.

The only other known cases of the suppression of the free-swimming stage among the *Cirripedia* are in the aberrant Ascothoracic genera *Laura* and *Dendrogaster*, the Acrothoracic genus *Cryptophialus*, and the Rhizocephalid *Thompsonia*. The life-history of *Cryptophialus* was known to Darwin (Monogr., ii, pp. 102, 579).

Presuming that the life-history runs nearly the same course in all the species of *Scalpellum*, we can draw up from the stages we know the following composite picture of the life-history.

The ova are much larger and less numerous than in the *Lepadidae*. They pass through the *Nauplius* and *Metanauplius* stages and become typical *Cypris*-larvae within the capitulum of the mother. The *Nauplius* and *Metanauplius* stages are of very transient duration; in fact there is no true *Metanauplius*, and possibly no true *Nauplius* stage, because the cirri appear to be developed as soon as the anterior appendages (cf. *micrum*). Soon after the development of the cirri, the bivalve shell takes form. When this is complete and the larva has attained the typical *Cypris* structure, the egg-membrane or chorion is thrown off (cf. *brevicaulis* and *eumitos*).

Aurivillius thinks that the liberated *Cypris*-larva has but limited means of progression, and Hoek (1907) is inclined to believe that they merely creep out and take up a position either on or near by the mother. The South African material affords no conclusive evidence on this point.

After the attachment of the *Cypris*-larva, the *Cypris*-shell is not thrown off until the primordial valves of the terga, scuta, and carina have been formed (cf. *eumitos*). When this casting off actually occurs we do not know. But in *eumitos* it is before the full complement of valves has been developed, the rostral latera being absent.

The first peduncular plates appear (after casting off the *Cypris*-shell ?) on the carinal side and are in *valvulifer*, *eumitos*, and *stearnsi*, four in number. Later plates are interpolated between these and the capitulum.

As to the order of appearance of the capitular valves we have very little evidence. In *eumitos* a recently attached *Cypris*-larva shows, besides the primordial valves, the carinal and upper latera and also the incipient inframedian latera. After the casting off of the *Cypris*-shell and the extension of the valves so as to encase the animal almost completely, the rostral latera (and rostrum ?) are developed. Trustworthy corroborative evidence was not found in *valvulifer* as there was no specimen in just that particular stage.

Comparing this sequence with that found in the allied genus *Smilium*: in South African specimens of *pollicipedoides* it was found that the inframedian latus was the last to appear. It will also be remembered that in *Scalpellum* proper it is the inframedian latus which is most variable and which tends in several species to disappear. The interpretation of these isolated facts must be left until we possess more information.

Stewart's paper on the post-larval development may also be consulted (1911, Mem. Ind. Mus., vol. iii, No. 2), although he deals mainly with the internal anatomy (reproductive organs) and only incidentally with the growth of the valves (cf. pp. 37, 38, pl. iv, figs. 2 and 5). Also Broch, Vidensk. Medd. naturh. For., vol. lxxiii, 1922.

[Note.—Since the above remarks were written in 1916, Nilsson-Cantell has published (Cirripeden-Studien Zoolog. Bidrag. fr. Uppsala, vol. vii, 1921) an important paper, one section of which deals with larval forms and the abbreviated life-history. He confirms the presence of the nauplius stage in *Scalpellum scalpellum* (= *vulgare*), but gives reasons for believing that under normal conditions the nauplius probably does not become free-swimming. He also finds *Metanauplius* and *Cypris*-stages within the mantle-cavity of the following species: *gibberum* Auriv., *convexum* Nils.-Cant., *compactum* Borrad., and *ventricosum* Hoek. He notes that the cause of this abbreviation in development cannot be attributed to the bathymetrical or temperature factors in the environment.

Nilsson-Cantell's results are very valuable as they confirm my own observations. We now know of 24 species in which the *Cypris* (or *Metanauplius*) has been found within the capitulum of the ♀. Although this is a very small percentage of the known species, nevertheless I am more strongly than ever convinced that if the material in the various museums and institutions were properly examined, the proof would be forthcoming that the normal course of larval development in the genus *Scalpellum* is intracapitular and not pelagic.

Nilsson-Cantell further has made the interesting discovery of an

abbreviated life-history in the sessile barnacle *Tetrachita divisa* Nils.-Cant., a tropical species living in the littoral zone.

This does not appear to be the case with the S. African species *serrata*. The ova are relatively minute and are produced in very large numbers; consequently it may be presumed that they do not develop further than the nauplius stage within the capitulum.]

II. SYSTEMATIC PART.

THORACICA.

PEDUNCULATA.

Key to the South African families.

1. Peduncle scaly. A basal whorl of plates below the principal 5.
Umbo of scutum above the middle of the occludent margin . . . *Scalpellidae*.
2. Peduncle naked.
 - a. Valves 3-5 (sometimes reduced). Umbo of scutum at or near rostral angle *Lepadidae*.
 - b. Valves wanting or greatly reduced, inconspicuous. Umbo of scutum, when present, in middle of occludent margin . . . *Alepadidae*.

Fam. SCALPELLIDAE.

1851. *Lepadidae* (part). Darwin, Monogr. Lepadid., p. 8.

1905. *Polyaspididae*. Gruvel, Monogr. Cirrip., p. 16.

1907. *Scalpellinae* (subfam.). Pilsbry, Bull. U.S. Nat. Mus., No. 60, pp. 3, 4.

1909. *Pollicipedidae*. Annandale, Mem. Ind. Mus., vol. ii, No. 2, p. 63.

1911. *Scalpellidae*. Krüger, Abh. K. Bay. Ak. Wiss. II. Suppl., Bd. 6, Abh., p. 7. (Hereafter cited as Beitr. Cirrip. Ostas.)

1922. *Scalpellidae*. Broch, Vidensk. Medd. naturh. For., vol. lxxiii, p. 227. See also Pilsbry, Pr. Ac. Philad., vol. ix, p. 104, 1908.

In Ann. Mus. Marseille, vol. xv, 1916, p. 37, Joleaud has proposed a classification of the genus *Scalpellum* which seems to offer certain advantages over previous attempts. It is based on a study of the evolutionary tendencies in the growth and atrophy of the valves. The genus or subgenus *Calantica* Gray has been removed altogether from *Scalpellum*, and is made a subgenus of *Pollicipes*. As no species of *Calantica* occurs in S. Africa this grouping need not be discussed here.

Gray's other genus, *Smilium*, is made a subgenus of *Scalpellum*, as in Pilsbry's 1907 arrangement, but under Hoek's name of *Protoscalpellum*.

In 1908 Pilsbry, rightly as it seems to me, resurrected *Smilium* as a separate genus distinguished on the one hand from *Calantica* by the elevation of the upper latera (M 2 of Joleaud) above the basal whorl, and on the other hand from *Scalpellum* on account of the structure of the male. Further, he separated off from *Smilium* those species in which the male has only 3 valves and a capitulum scarcely differentiated from the peduncle as *Euscalpellum* Hoek.

Joleaud regards these species as forming a section of *Protoscalpellum* under the term *Pseudoscalpellum*. He reinstitutes the term *Euscalpellum* very unfortunately, and, one might say, not a little unkindly towards Hoek, for an entirely different group representing the phyletically most advanced true *Scalpellums*.

There is no doubt that Pilsbry's method of making the male do its share in constructing a phyletic grouping as well as the hermaphrodite is scientifically sound. Even when the hermaphrodites alone are considered, there are good reasons for separating off *Euscalpellum* Hoek.

If regarded as a genus, *Smilium* must, of course, take precedence over *Protoscalpellum*.

Key to the South African genera.

1. Valves more than 8. Peduncle not ending below in a calcareous cup or row of discs.
 - a. Female or hermaphrodite with 15 valves (exceptionally 9). Subcarina present. Male with 6 well-developed valves and distinctly divided into capitulum and peduncle *Smilium*.
 - b. Female or hermaphrodite with not more than 14 plates. Subcarina absent. Male sac-like, not divided into capitulum and peduncle, without mouth or cirri, valves minute or wanting . . . *Scalpellum*.
2. Valves never more than 8, rostrum and latera small, rudimentary or even absent. Peduncle ending below in a cup or a row of disks. Corallidomous
Lithotrya.

Gen. SMILIUM Gray.

1825. *Smilium*. Gray, Ann. Philos. N.S., vol. x, p. 100.
 1851. *Scalpellum* (part). Darwin, Monogr. Lepadid., p. 215.
 1905. „ (part). Gruvel, Monogr. Cirrip., p. 23.
 1907. *Protoscalpellum*. Hoek, Siboga. Exp. Monogr., 31A, p. 58.
 1907. *Smilium*. Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 13.

1908. *Smilium*. Pilsbry, Proc. Ac. Sci. Philad., vol. lx, pp. 106, 107.
 1909. „ Annandale, Rec. Ind. Mus., vol. iii, pt. 3, p. 267.
 1910. „ Annandale, *ibid.*, vol. v, pt. 3, p. 145.
 1910. „ Annandale, Vidensk. Medd. Natur. For. Kbhvn.,
 1910, p. 211.
 1911. „ Annandale, Tr. N. Zeal. Inst., vol. xliii, p. 164.
 1911. „ Annandale, Ann. Mag. Nat. Hist. (8) 7, p. 589.
 1911. „ Krüger, Beitr. Cirrip. Ostas., p. 15.
 1912. „ Pilsbry, Proc. U.S. Nat. Mus., vol. xlii, p. 291.
 1914. „ Annandale, Rec. Ind. Mus., vol. x, pt. 5, p. 273.
 1916. *Protoscalpellum*. Joleaud, Ann. Mus. Marseille, vol. xv, p. 40.
 1922. *Smilium*. Broch, Vidensk. Medd. naturh. For., vol. lxxiii,
 p. 234.

Key to the South African species.

1. Valves 15. Upper latus well developed *pollicipedoides* Hk.
2. Valves 9. Upper latus quite rudimentary, or absent . . . *hypocrites* n. sp.

Smilium pollicipedoides (Hoek).

1905. *Scalpellum pollicipedoides*. Hoek, P. Ak. Amsterd., vol. vii, p. 92, figs. 4–6 (not described).

1907. *Scalpellum pollicipedoides*. Hoek, Siboga. Exp. Monogr., 31a, p. 60, pl. v, figs. 9–11.

1908. *Smilium pollicipedoides*. Pilsbry, Proc. Ac. Nat. Sci. Philad., vol. lx, p. 107.

The resemblance of the South African specimens to the typical East Indian specimens is so close that only the few slight differences need be pointed out.

The upper latus has 2 divergent ridges, varying in distinctness, running from the umbo to the basal margin, which is slightly concave for the greater part of its length. The scales on the peduncle are more numerous and closer together in the larger, but not in the smaller specimens. The carina is less strongly indented when viewed in profile. In size they are much larger than Hoek's specimens.

Some of the specimens of A 323 (numbered separately A 4111) have the rostral latera, carinal latera, and inframedian latera more or less directed outwards; and in one specimen the inframedian latus on one side is strongly recurved downwards. This seems to show that *pollicipedoides* is closely related to *S. scorpiis* Auriv., 1894.

Aberration.—One specimen of No. A 323, capitulum length 5 mm., is deep orange-brown all over, and, except for a few scales at the base of the peduncle, appears to have no calcareous scales or valves at all. The limits of the valves can be distinguished, and dissection revealed the presence of very thin pellucid chitinous valves.

Male.—No. A 3928, capitulum length 7 mm., contained one specimen, similar in general shape to that figured by Hoek, but larger: .9 mm. \times .7 mm. Two of the largest specimens of No. A 323 also contained males, 2 in 1, 1 in the other. These are proportionately narrower, .9 mm. \times .5 mm., having the greatest width across the valves, thence narrowing regularly to the point of attachment. In size and shape the valves closely correspond with Hoek's description and figure, especially those of No. A 3928. The outer surface of the peduncular portion is covered with extremely minute spinules.

No frena or dorsal processes were found. No males were found in specimens with a capitulum length less than 7 mm.

Ova in an undifferentiated stage, measuring .2 mm., and numbering at least 150, were found in some specimens. They cohere together and form a compact mass at the bottom of the mantle cavity.

Length of capitulum, 1.5–12 mm.; of peduncle, 1–10 mm.

Colour.—In spirit, valves white or pinkish; membrane covering the peduncle and between the valves pale or (No. A 323) deep orange-brown, the membrane over the valves also orange coloured but paler.

Locality.—Durnford Point, N.E. by E., distant 9 miles (Zululand), 13 fathoms, 16 specimens; O'Neill Peak, N.W. $\frac{1}{4}$ W., distant 9 miles (Zululand), 90 fathoms, 1 specimen; Itongazi River, N.W. $\frac{3}{4}$ W., distant 3 miles (Natal), 25 fathoms, 1 specimen attached to a *Balanus trigonus* growing on the base of a horny sponge; Durnford Point, N., distant 12 miles (Zululand), 34 fathoms, 4 specimens on a Hydroid. S.S. "Pieter Faure," 8/2/01, 28/2/01, 14/3/01, and 28/2/01. (S.A.M., Nos. A 323, A 324, A 3928, and A 4089.)

Geogr. Distribution.—5° 28' S., 134° 53' E., 57 metres. (Hoek.)

The series shows that the inframedian latus does not appear until the capitulum has reached a length of about 4 mm. Hoek has described a specimen which has 2 additional valves in the lower whorl and which he regards as a reversion to the phylogenetically older *Mitella* (*Pollicipes*) type. In the genus *Scalpellum*, as noticed below, a certain group shows a strong tendency towards the reduction and elimination of this inframedian valve. I will not venture to discuss these points here, since to do so adequately would require

more knowledge of the post-embryological stages in the *Scalpellidae* than we yet possess.

Smilium hypocrites n. sp.

(Plate I, figs. 1, 2.)

Capitulum with 9 (11) valves, partly reduced and thus not closely fitting, covered with a fine membrane, smooth, lines of growth faintly visible; ocludent margin concave, carinal margin gently convex.

Scutum pyriform, ocludent margin slightly concave, inner margin nearly straight passing imperceptibly into the rounded basal margin, umbo at the acute apex.

Tergum narrow triangular, ocludent margin very short, about $\frac{1}{3}$ length of carinal margin, umbo at the subacute apex.

Carina longer than tergum, its apical umbo projecting slightly beyond that of tergum, very slightly bowed, base square, roof convex.

Subcarina broadly triangular, a little wider than high, not concealing base of carina.

A much reduced, crescentic valve, its curve corresponding with that of the inner basal margin of scutum, probably represents the carinal latus. An inframedian latus is therefore absent.

In some specimens there is at the upper end of the carinal latus a minute granule representing apparently the upper latus.

Rostrum much wider than high, extending laterally to about the middle of basal margin of scutum.

Peduncle half as long again as capitulum, with a few incomplete and irregularly developed rings of minute granules at its upper end, lower end quite naked. These granules vary considerably in development, being sometimes nearly wholly absent, but never strongly enough developed to form a protective armour to the peduncle; those on the carinal side are always slightly larger and more numerous than those on the lateral parts, and the rostral side is always entirely free from them, being opposed to the object to which the animal is fixed.

Labrum blunt, scarcely at all produced.

Mandible with 3 teeth, 1st further from 2nd than 2nd from 3rd, an accessory tooth between 1st and 2nd and between 2nd and 3rd, inner angle obtuse, bifid in one of the mandibles, denticulate in both.

Maxilla, outer angle with 1 large stout spine, inner edge straight with ca. 12 smaller spines.

Outer maxilla ovate, not strongly setose.

Labial palp rather short and stout, apex subacute, with a small tuft of setae.

First cirrus, the 6th jointed, posterior ramus slightly longer than the 5-jointed anterior ramus, neither ramus expanded.

Each joint of the other cirri with 2 pairs of long setae and a shorter pair near the base.

Caudal appendages short, broadly oval, apical margin rounded, fringed, with setae.

Penis $\frac{1}{3}$ length of 6th cirrus, rather stout, tapering gradually, without setae except a few on the distal portion, apex subacute with a tuft of setules.

No frena or dorsal processes were found.

No complementary males could be found in any of the twenty specimens examined. As only the one set of specimens was taken, it is probable that males are only developed at certain times.

Some of the specimens were ovigerous, but in every case the ova were in an undifferentiated condition and not very well preserved. The number was small, between 20 and 30, size .2 mm.

Length of capitulum, 4 mm.; of peduncle, 5–6 mm. *Breadth*, 2 mm.

Colour.—In spirit, valves white, peduncle and spaces between the valves yellowish-brown.

Locality.—Durnford Point, N.W. $\frac{3}{4}$ W., distant 12 miles (Zululand), 90 fathoms. Many specimens on *Villogorgia mauritiensis*. S.S. "Pieter Faure," 28/2/01. (S.A.M., No. A 4110.)

The specimens are completely overgrown by the coenenchyma and polyps, just as if they were the horny axis of the Gorgonian itself. Consequently they are extremely difficult to distinguish from the short branches of the latter. In fact it was only by an accident, while removing some sessile barnacles, that I became aware of them. After that I searched carefully all the *Gorgonaceae* in the collection, but failed to find any further specimens either on the other specimens of *Villogorgia* or on any other forms.

To the protection afforded by the spicules of the Gorgonian is evidently to be ascribed the reduction in the number and size of the valves and scales.

Although there is no proper upper latus here between the scutum and carina unless the minute "pin-point" valve, noticed above as being occasionally present, be regarded as its representative, I think there is no doubt that this species is a true *Smilium* in process of simplification owing to its protected habitat. It confirms the views of Hoek (*loc. cit.*, 1907, p. 63) and Pilsbry (*loc. cit.*, 1908, p. 109) that there is an inherent tendency in the scalpelliform barnacles towards reduction of the valves. Hoek considers *Mitella* (*Pollicipes*), with

many plates, older than *Scalpellum* with fewer; and Pilsbry notes in the subgen. *Arcoscalpellum* the frequent reduction of the inframedian latus (see also remarks on phylogeny in Broch, Vidensk. Medd. naturh. For., vol. lxxiii, 1922).

Gen. SCALPELLUM Leach.

1817. *Scalpellum*. Leach, Journ. de Physique, vol. lxxxv, p. 68.
 1851. „ Darwin, Monogr. Lepadid., p. 215.
 1883. „ Hoek, Challeng. Rep., vol. viii, p. 59.
 1894. „ Aurivillius, K. Sv. Vet. Ak. Handl., vol. xxvi,
 No. 7.
 1905. „ Gruvel, Monogr. Cirrip., p. 23.
 1905. „ Annandale, Mem. As. Soc. Beng., vol. i, pt. 5,
 p. 75.
 1906. „ Annandale, Ann. Mag. Nat. Hist., ser. 7,
 vol. xvii, p. 390.
 1906. „ Gruvel, Bull. Mus. d'Hist. Nat. Paris, v, p. 271.
 1907. „ Gruvel, Bull. Soc. Zool. Fr., vol. xxxii, No. 5-6,
 p. 158.
 1907. „ Hoek, Siboga. Exp. Monogr., 31A, p. 54.
 1907. „ Pilsbry, Bull. Bur. Fish., vol. xxvi, p. 181.
 1907. „ Pilsbry, Bull. U.S. Nat. Mus., No. 60, pp. 6, 13.
 1911. „ Pilsbry, Bull. Bur. Fish., vol. xxix, p. 61.
 1911. „ Krüger, Beitr. Cirrip. Ostas, p. 18.
 1912. „ Gruvel, Bull. Inst. Oc. Monaco, No. 241, p. 1.
 1913. „ Annandale, Rec. Ind. Mus., vol. ix, pt. 4, p. 227.

Only the chief references are given above; others will be found below where a comparison of the South African forms with extra-African forms is necessary.

The following arrangement of the species is purely artificial and in nowise phyletic:—

Key to the South African species.

I. Valves perfectly calcified.

A. Umbo of inframedian latus at base.

1. Roof of carina convex.

a. Carina angularly bent, umbo remote from apex.

i. Upper latus quadrangular. Adult with accessory valves

valvulifer Annand.

ii. Upper latus quadrant-shaped, incised . . . *ornatum* (Gray).

iii. Upper latus triangular . . . *faurei* n. sp.

- b. Carina simply arched, umbo apical or sub-apical.
 - i. Upper latus triangular, not incised, valves cancellate
cancellatum n. sp.
 - ii. Upper latus quadrant-shaped, more or less incised.
 - a. Carinal margin of carinal latus reflexed outwards
subalatum n. sp.
 - β. Carinal margin not reflexed.
 - * Carinal margin of carinal latus ridge-like, thickened.
Valves striate *capense* n. sp.
 - ** Carinal margin not thickened. Valves smooth
agulhense n. sp.
 - 2. Roof of carina flat, square in section.
 - a. Tergum scarcely projecting above apex of carina
brachium-cancrī, Welt.
 - b. Tergum strongly projecting *porcellanum* n. sp.
 - 3. Roof of carina bordered by more or less prominent ribs.
 - a. Rostral latus low.
 - i. Upper latus not longer than broad.
 - α. Capitulum and peduncle smooth . . . *brevicaulis* n. sp.
 - β. Capitulum and peduncle setose . . . *eumitos* n. sp.
 - ii. Upper latus longer than broad * *rutilum* Darw.
 - b. Rostral latus high.
 - i. Rostrum very short *uncinatum* n. sp.
 - ii. Rostrum long *natalense* n. sp.
 - B. Umbo of inframedian latus at or near the middle . *sinuatum* Pilsbry.
 - C. Umbo at the more or less acute apex.
 - 1. Rostral latus low *botellinae* n. sp.
 - 2. Rostral latus high *micrum* Pilsbry.
- II. Valves imperfectly calcified (*Mesoscalpellum*) . . . *imperfectum* Pilsbry.

Scalpellum valvulifer Annand.

Scalpellum darwini. Steenstrup MS. (name now preocc.).

1910. *Scalpellum valvulifer*. Annandale, Vidensk. Medd. Naturf. For. Kbhvn., 1910, p. 214, pl. 3, figs. 1, 2.

The mandible sometimes has only 2 teeth besides the inner angle, which is not often merely bifid but has several minute denticles. Maxilla with the inner edge straight and scarcely any trace of a notch. Caudal appendages slender, as long as peduncle of 6th cirrus, tipped with 2 groups of 2-3 setae. Penis absent.

In other respects there is nothing to add to Annandale's description except that here the rostrum is perfectly visible and not at all concealed by the rostral latera.

* Species preceded by an asterisk are not represented in the S. African Museum collections.

Annandale says that "the valvules appear to be split off from the valves rather than to arise from separate centres of calcification." From an examination of cleared and mounted preparations I find that the valvules do arise from separate centres of calcification, although I would not deny that they may sometimes originate by splitting off. Owing to mutual pressure their margins are bound to correspond with those of the valves, and, consequently, the appearance of "splitting off" is produced. I have not been able to discover a single clear instance of splitting off, whereas in the membrane between two valves, the valvules, in different stages of growth, down to microscopic pin-points in size, can be easily discerned, and the centre of calcification is always midway between the 2 valves. The umbo of a valvule is thus central and growth proceeds concentrically. The production of secondary and tertiary sets of valvules proceeds on similar lines.

Male.—One in a pouch under each scutum. Females with a capitulum length under 3.5 mm. did not contain any males, though the beginnings of the pouches were visible. Oval, .5 mm. \times .3 mm., surface extremely minutely spinulose. Antennae very distinct, as also 2 or 3 sets of muscle strands crossing the walls. No internal structure visible other than the testis. Apex turned at right angles to the plane of the rest of the body, *i.e.* projecting inwards from the scutum, with 4 small oval, subequal valvules.

Length of capitulum, 6 mm.; of peduncle, 4 mm. *Breadth*, 3 mm.

Colour.—In spirit, valves white, intervening membrane pale brownish.

Locality.—Walker Point, N.E. by N. $\frac{1}{2}$ N., distant 7 miles, 47 fathoms, many specimens; Rockland Point, N.W. by W. $\frac{1}{2}$ W., distant 1 mile (False Bay), 22 fathoms, 3 specimens; St. Francis Bay, 26 fathoms, 1 specimen; Knysna Head, N., distant 10 miles, 52 fathoms, several specimens; Cape Seal, W. by N. $\frac{1}{2}$ N., distant 7 miles, 39 fathoms, several specimens; off Nanquas Peak (Algoa Bay), 40 fathoms, several specimens; Cape Point, N.W. by W. $\frac{3}{4}$ W., distant $2\frac{1}{2}$ miles, 42 fathoms, 1 specimen; Duminy Point (off Saldanha Bay), E. by N. $\frac{1}{2}$ N., distant 8 miles, 87 fathoms, 5 specimens. S.S. "Pieter Faure," 11/10/00, 24/9/02, 2/3/99, 2/7/02, 20/4/06, 29/3/04, 6/6/00, and 17/3/02. (S.A.M., Nos. A 307, A 303, A 3908, A 4090, A 4091–2–3, and A 4311 respectively.)

Geogr. Distribution.—China Sea. (Annandale.)

All the specimens are attached to worm-tubes, usually segregated in large numbers. They appear to monopolise the situation, as no

other barnacles are fixed to these worm-tubes. The tubes of No. A 307 are several centimetres long, but scarcely 2 mm. in diameter, composed of a tough horny substance, externally iridescent, perhaps belonging to some species of *Chaetopterid*; other tubes are those of *Telepsavus costarum*, also a *Chaetopterid*.

The following outline of the life-history has been pieced together from a study of the numerous specimens of No. A 307. Although there are a large number of small, medium, and large-sized individuals, there are very few of the smallest size showing the very early changes. There are also only a few recently attached *Cypris*-larvae.

Ova, *Metanauplius* and *Cypris*-larvae, were all found within the mantle cavity in various individuals. A brood seems never to exceed 30 in number, all the individuals of which appear to develop at the same rate. No case of ova and *Cypris*-larvae in the same capitulum was discovered.

The ova are oval, $\cdot 5 \times \cdot 3$ mm.

The *Metanauplius* measures $\cdot 75 \times \cdot 4$ mm.

The *Cypris*-larva is of about the same size as the *Metanauplius* and pale brown (preserved) in colour.

I was unable to find any *Cypris*-larva showing, while still within the mother, the primordial valves. It may be, therefore, that these are developed after the escape of the *Cypris* from the parental capitulum.

A few recently attached *Cypris*-larvae were found. Those destined to become females are attached to the worm-tubes; but the male *Cypris* attaches itself to the occludent margin of the scutum of specimens about 3 mm. in length. No difference in size or shape between ♂ and ♀ *Cypris* could be detected, such as Stewart (1911, Mem. Ind. Mus., vol iii, pt. 2, pp. 37, 38, pl. iv, figs. 1-4) has recorded in *S. squamuliferum*.

The earliest stage found, in which the beginnings of the valves are visible, measures in total length 1 mm. The *Cypris*-shell has just been cast off. The primordial valves have been extended beyond their original limits, the carinal and upper latera are distinct, and there are traces of the inframedian latera and rostrum.

Second stage (these stages do not, of course, necessarily correspond with the periods between successive ecdyses).—Capitular length, $\cdot 9$ mm. All the valves present except the rostral latera, but on this point the specimen does not afford very clear evidence. Upper latera square. Inframedian latera oval. No peduncular plates.

Third stage.—Capitular length, $\cdot 9-1$ mm. Four peduncular plates,

the 2 largest on the carinal side, 2 smaller lateral ones extending round and almost meeting below rostrum.

Fourth stage.—Capitular length, 1-2 mm. A second row of peduncular plates developed, consisting of 1 rostral, 1 carinal, and 1 on each side, thus alternating with the primary row. Upper latus with the lower margin differentiated into 2 facets abutting one against the inframedian, the other against the carinal latus. The former oblong, higher than wide. Primordial valve of tergum very prominent at this stage and projecting beyond the occludent margin.

Fifth stage.—Capitular length, 2.5 mm. By this time the valves have attained their normal shape, and several rows of peduncular plates have been developed. The primordial valve of the tergum has ceased to project owing to the extension of the occludent margin of the valve.

Sixth stage.—Capitular length, 3-3.5 mm. Specimens smaller than this do not contain males. But there are a few specimens of this size, each with a *Cypris*-larva attached to the occludent margin of the scutum.

Seventh stage.—Capitular length, 4.5 mm. The first series of valvules now begins to appear. Breeding also seems to begin at this stage, no ova or larvae being found in specimens of less size. Secondary and tertiary series of valvules are developed only in the largest specimens.

Scalpellum ornatum (Gray).

1848. *Thaliella ornata*. Gray, Proc. Zool. Soc. Lond., 1848, pt. 16, p. 44. (Annulosa plate.)

1851. *Scalpellum ornatum*. Darwin, Monogr. Cirrip., p. 244, pl. 6, fig. 1.

1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 567.

Umbones of the rostral and carinal latera projecting only slightly beyond the profiles of rostrum and carina in all the specimens except those from Gordon's Bay. The ridges on the upper latus and carina vary, being in some very distinct, in others barely distinguishable.

Mouth-parts as described by Darwin. Anterior ramus of 1st cirrus very little shorter than posterior, both 6-jointed. Caudal appendages equal to width of peduncle of 6th cirrus, oval, with minute spinules on margins but no long spines on the blunt apex. (Darwin says there are 4 such spines.) No penis.

Male.—One in each scutal pouch. Oval, $.75 \times .4$ mm.; surface very minutely spinulose, apex with 4 small oval valvules, 2 larger than the other 2, antennae as described by Darwin. Testis distinct, but there is no trace of the eye or any thoracic or abdominal appendages which Darwin says he found in a dried specimen. Either the preservation of the specimen led Darwin to a faulty observation, or, what seems more likely, he examined ♂♂ in which the degeneration of the appendages had not proceeded so far as in the present specimens. Hoek has observed and figured 3 stages of the ♂ of *velutinum* (1883, *Challeng. Rep.*, vol. viii, p. 98, pl. ix, figs. 7–9) showing this retrogression.

Larval forms: ova, *Metanauplii* and *Cypris*-larvae were found in some individuals within the mantle cavity. In one specimen, ova in an undifferentiated stage were found, together with a few *Cypris*-larvae. Size of *Cypris*-larva, $.8 \times .4$ mm. Brood not exceeding 30 in number.

Length of capitulum, 6.5 mm.; of peduncle, 2.5 mm. *Breadth*, 4 mm.

Colour.—In spirit, white.

Locality.— $32^{\circ} 45' S.$, $28^{\circ} 26' E.$ (off Cape Morgan), 36 fathoms, 2 specimens on a Hydroid; $33^{\circ} 6' S.$, $28^{\circ} 11' E.$ (off East London), 85 fathoms, 1 specimen on a Hydroid; Sandy Point, N.E. by N., distant 6 miles (off Cape Morgan), 51 fathoms, 1 specimen on a Hydroid; Cape Morgan, N. $\frac{1}{2}$ W., distant 10 miles, 77 fathoms, 7 specimens on Hydroid; Cape St. Francis, N.E. by E., distant 32 miles, 74 fathoms, 1 on a Hydroid with *S. uncinatum*. S.S. "Pieter Faure," 12/1/99, 28/1/99, 14/8/01, 26/7/01, and 19/2/02 respectively. Also Gordon's Bay in False Bay, 10 fathoms. (S.A.M., Nos. A 3906, A 4085, A 4088, A 4049, A 4103, and A 4398.)

Distribution.—Algoa Bay. (Gray.)

Aberration (Plate I, fig. 3).—One specimen taken in the same haul, and on the same specimen of Hydroid as No. A 3906 above, presents a curious condition, and would undoubtedly have been considered a different species had it occurred by itself.

All the plates are like those of the typical *ornatum*, except the rostral and inframedian latera and the carina. This latter has the umbo quite apical although the apex reaches to the same point on the tergum as does the apex (not the umbo) in the typical form. The rostral latus is much larger, though of the normal shape, having grown inwards so far that its upper angle touches the upper latus and thus separates the scutum and inframedian latus. This latter valve has

diminished in width to accommodate the rostral latus, so that it is nearly 4 times as high as wide, umbo at the basi-rostral angle as in the normal *ornatum*.

This specimen may, of course, prove to belong to a separate species when more material is dredged, but for the present I prefer to place it here.

Length of capitulum, 5 mm. ; of peduncle, 2 mm. *Breadth*, 3 mm.

Colour.—In spirit, white.

Locality.—32° 45' S., 28° 26' E. (off Cape Morgan), 36 fathoms, 1 specimen on a Hydroid with typical *ornatum*. S.S. "Pieter Faure," 12/1/99. (S.A.M., No. A 322.)

Scalpellum faurei n. sp.

(Plate I, fig. 4.)

Capitulum subquadrangular, occludent and carinal margins slightly convex, subparallel, with 13 or 14 closely fitting valves ; all the valves finely striate radiately, covered by a very fine cuticle sparsely clothed with short and very fine hairs.

Scutum trapezoidal, lateral margin straight.

Tergum, scutal margin longer than occludent margin, acute, not recurved.

Upper latus triangular, tergal and scutal margins subequal, carinal margin slightly excavate at base for reception of the apex of carinal latus.

Carina not strongly arched below umbo, but here bent almost at right angles, intraparietes very prominent, faintly striate, roof convex, sides wide at base, rapidly narrowing towards umbo, 2 striae rather stronger than the others form slight dorso-lateral ridges from umbo but not reaching base.

Carinal latus triangular, umbo meeting its fellow below base of carina but not prominent, rostral margin concave.

Inframedian latus narrow, high, curved, umbo at base, widening slightly upwards, apex acute touching upper latus.

Rostral latus triangular, nostral margin short, scutal longer than basal margin, apex not touching upper latus.

Rostrum either absent or, if present, scarcely visible externally, minute, elongate oval, situate in middle of the suture between the rostral latera on the inside.

Peduncle short with 7 rows of 4–5 closely imbricated scales.

Labrum obtusely produced.

Mandible with 3 teeth, 1st more distant from 2nd than 2nd from 3rd, a few minute denticles on outer margin of 2nd and 3rd, inner angle subacute, denticulate.

Maxilla with a notch between the outer 4 unequal spines and the inner 6.

Outer maxilla ovate, setose.

First cirrus, the 7-jointed, posterior ramus a little longer than the 6-jointed anterior ramus, neither strongly expanded.

Each joint of the other cirri with 5 pairs of setae, increasing in length distally.

Caudal appendages half length of 6th cirrus, 1-jointed, tapering, apex subacute, setose.

No penis.

Male.—One in each scutal pouch. Oval, $\cdot 5 \times \cdot 3$ mm.; surface extremely minutely spinulose, antennae nearly at inner end, apex with 4 valvules, the larger 2 oval, the smaller subcircular. A trace of the cirri can just be discerned.

Larvae in an early *Metanauplius* stage, showing the 1st antennae and rudiments of the cirri, but no trace of any other appendages; also in another specimen, *Cypris*-larvae, $\cdot 75 \times \cdot 4$ mm., of typical structure. Both stages found within the mantle cavity, less than 20 in number.

Length of capitulum, 6 mm.; of peduncle, 2 mm. *Breadth*, 3 mm.

Colour.—In spirit, white.

Locality.—Cape Morgan, N. $\frac{1}{2}$ W., distant 10 miles, 77 fathoms, 10 specimens on a dead Gorgonian stem and 1 juv. on a *Melitodes*-like Gorgonian; East London, N. $\frac{3}{4}$ W., distant 14 miles, 70 fathoms, 2 juv. on *Villogorgia mauritiensis*; Sandy Point, N. $\frac{1}{4}$ E., distant 10 miles (off Cape Morgan), 95 fathoms, 5 juv. on *Allopora nobilis*. S.S. "Pieter Faure," 26/7/01, 12/7/01, and 14/8/01. (S.A.M., Nos. A 4095 (the juv. specimen, A 4107), A 4106, and A 4299.)

Closely allied to *S. hoeki* Gruvel (1902, Tr. Linn. Soc. Lond., vol. viii, pt. 8, p. 290, pl. viii, figs. 6–9 and 16–20), but easily distinguished by the absence of ridges on the valves and the radiate direction of the striae, and by the rudimentary rostrum. Also the caudal appendages are here 1-jointed, not 3, as in Gruvel's species from the Pacific Ocean.

Scalpellum cancellatum n. sp.

(Plate I, fig. 5.)

Capitulum ovate, carinal margin much more convex than ocelludent, with 14 closely fitting valves covered by an extremely fine cuticle, all the valves with close set radiate and more widely separated concentric striae, giving a cancellate appearance.

Scutum trapezoidal, lateral margin straight, a slight ridge from umbo to basi-lateral angle.

Tergum, ocelludent margin nearly straight, scutal margin longer than ocelludent, apex acute.

Upper latus triangular, carinal margin slightly convex, not emarginate, scutal margin slightly raised, rib-like.

Carina simply arched, umbo apical at about middle of tergum, sides wide basally, base rounded, roof convex with slight median, submedian and lateral ribs.

Carinal latus triangular, umbo meeting its fellow below base of carina, carinal margin slightly thickened but not at all reflexed, rostral margin concave.

Inframedian latus narrow, linear, curved, umbo at base, almost under the basal margin of rostral latus; in one specimen there are 4 radiate striae, in the other only 2; apex truncate, meeting both upper latus and basi-lateral angle of scutum.

Rostral latus triangular, basal margin short, upper inner angle almost reaching upper latus, umbo slightly projecting, rostral margin very short.

Rostrum small but distinct, sublinear, slightly wider above.

Peduncle short, with 8 rows of 8-10 closely imbricated scales.

Labrum obtusely produced.

Mandible with 3 teeth decreasing in size, inner angle subacute, denticulate.

Maxilla, inner edge with a scarcely defined notch. Outer maxilla ovate, setose.

First cirrus, rami subequal, the anterior 6-jointed, the posterior 8-jointed, neither expanded.

Each joint of the other cirri with 4 pairs of long setae with a shorter pair below them.

Caudal appendages $\frac{3}{4}$ length of peduncle of 6th cirrus, 3-jointed, setose.

No penis.

Male.—One in each scutal pouch. Oval-quadrangular, $.5 \times .3$ mm.,

surface very minutely spinulose, antennae nearly at inner end, apex with 4 (2 larger than the other 2) oval, feebly calcified valvules, testis distinct, no trace of cirri.

Cypris-larva.—A small number in the mantle cavity, of typical structure, yellowish, $\cdot 75 \times \cdot 5$ mm.

Length of capitulum, 6.5 mm.; of peduncle, 2 mm. *Breadth*, 3.75 mm.

Colour.—In spirit, white.

Locality.—36° 44' S., 21° 14' E., 250 fathoms, 1 specimen on worm-tube with *S. agulhense*; 36° 40' S., 21° 26' E., 200 fathoms, 1 specimen in a calcareous Polyzoon with *S. subalatatum*. S.S. "Pieter Faure," 17/7/06 and 18/7/06. (S.A.M., Nos. A 3915 and A 4087.)

Scalpellum subalatatum n. sp.

(Plate I, fig. 6.)

Capitulum lanceolate, stout at base, with 14 closely fitting valves covered by an extremely thin cuticle, all the valves radiately striate and marked with more widely distant concentric striae, these latter being best developed on the carina.

Scutum trapezoidal, occludent margin convex, lateral margin converging slightly at upper end, straight, a slight ridge from umbo to basi-lateral angle.

Tergum, occludent margin straight, shorter than scutal margin, apex acute.

Upper latus triangular, distinctly, though in a varying degree, notched at basal part of carinal margin for the reception of apex of carinal latus, 2 slight ridges from umbo to notch, one of them forming the scutal margin.

Carina extending half-way up tergum, simply but strongly arched, umbo subapical, sides narrow above, widening below, bordered by slight ribs, base rounded, quadrate, roof convex with median and submedian ribs.

Carinal latus triangular, rostral margin concave, carinal margin formed by a ridge which is strongly reflexed outwards.

Inframedian latus moderately wide at base, then strongly constricted, then again widening gradually to the quadrate apex, umbo at the base, projecting laterally downwards and outwards over the peduncle, separated from rostral latus by a wing-like expansion.

Rostral latus triangular, basal margin stout, umbo projecting, inner

apical angle widely separated from upper latus, rostral margin moderately short.

Rostrum linear-ovate, slightly wider at base.

Peduncle short, with 8 rows of 5 closely imbricated scales, the points of which are recurved outwards.

Labrum obtusely produced.

Mandible with 3 teeth decreasing in size, inner angle subacute, denticulate.

Maxilla with a small but distinct notch, outer spines 3, inner spines 7 in number.

Outer maxilla ovate, setose.

First cirrus, rami subequal; the anterior 7-, the posterior 8-jointed, both slightly expanded.

Each joint of the other cirri with 5 pairs of long setae and a pair of setules at base.

Caudal appendages $\frac{1}{2}$ length of peduncle of 6th cirrus, 1-jointed, with 3-4 apical setae.

No penis.

Male.—One in each scutal pouch. Oval, 0.6×0.4 mm., surface minutely spinulose, antennae near inner end, apex without any trace of valvules, testis distinct, cirri just visible in one specimen but not in another.

Cypris-larva.—A small number in the mantle cavity, of typical structure, yellowish, 0.8×0.5 mm.

Length of capitulum, 5 mm.; of peduncle, 1.5 mm. *Breadth*, 3 mm.

Colour.—In spirit, white.

Locality.— $36^{\circ} 40'$ S., $21^{\circ} 26'$ E., 200 fathoms, 7 specimens on a calcareous Polyzoan with *S. cancellatum*; Great Fish Point, N.W., distant 9 miles, 57 fathoms, 4 specimens on a Polyzoan as above; Cape St. Francis, N.E. by E. $\frac{1}{2}$ E., distant 36 miles, 70 fathoms, 4 specimens. S.S. "Pieter Faure," 17/7/06, 3/9/01, and 19/2/02. (S.A.M., Nos. A 3914, A 4097, A 4098.)

Closely allied to *S. capense*, the distinguishing features being mentioned under that species. Also allied to *cancellatum* and *agulhense*.

Scalpellum capense n. sp.

(Plate I, fig. 7.)

Capitulum oval, with 14 closely fitting valves, covered by a very fine cuticle, with short, moderately dense pile, all the valves rather

strongly striate radiately, with more widely separated concentric lines of growth.

Scutum trapezoidal, ocludent margin convex, lateral margin straight, apex acute, a slight ridge from umbo to basi-lateral angle.

Tergum, ocludent margin convex, shorter than scutal margin, apex subacute, slightly recurved, a slight ridge from umbo to carino-basal angle.

Upper latus subtriangular, with a notch in the middle of the carinal margin for the reception of the apex of carinal latus, 2 very slight ridges from umbo to notch.

Carina extending nearly $\frac{3}{4}$ up the tergum, simply arched, umbo apical, base V-shaped, roof convex with median and submedian ribs, sides flat, widening moderately downwards and bordered by slight ribs.

Carinal latus triangular, as high as wide, rostral margin concave, carinal margin also concave, formed by a broad ridge which runs to the apex and narrows towards the umbo, which projects slightly and meets its fellow over the base of the carina.

Inframedian latus narrow, at least twice as high as the width of the upper part, narrowing below and curving under the rostral latus, umbo at base, not projecting.

Rostral latus triangular, lateral margin convex, scarcely any basal margin, rostral margin very short, umbo not projecting, inner apical angle nearly touching upper latus.

Rostrum very small, triangular, widest below.

Peduncle with 8 rows of 5-6 closely imbricated scales.

Labrum obtusely produced.

Mandible with 3 teeth decreasing in size, outer margin of 2nd and 3rd minutely denticulate, inner angle blunt, denticulate.

Maxilla with a gap, but not a notch, between the outer 4 unequal spines and the inner ones.

Outer maxilla broadly ovate, moderately setose.

First cirrus, the 8-jointed posterior ramus slightly longer than the 5-jointed anterior ramus, neither strongly expanded.

Each joint of the other cirri with 4 pairs of long setae and a pair of setules below them.

Caudal appendages $\frac{3}{4}$ length of peduncle of 6th cirrus, incompletely divided into 3 joints, each apically setose.

No penis.

Male.—One in each scutal pouch. Oval, $.6 \times .4$ mm., surface minutely spinulose, antennae near inner end, apex with 4 feebly

calcified, subequal oval valvules, testis distinct, remains of cirri just visible.

Seventeen ova, badly preserved, and in an undifferentiated stage.

Cypris-larva.—Fifteen of normal structure in the mantle cavity, yellowish, 7×4 mm.

Length of capitulum, 5 mm. ; of peduncle, 1.5 mm. *Breadth*, 3 mm.

Colour.—In spirit, white.

Locality.—Lion's Head, N. 67° E., distant 25 miles (off Cape Peninsula), 131–136 fathoms, 1 specimen ; Lion's Head, S.E., distant 22 miles, 10 specimens on Polyzoan. S.S. "Pieter Faure," 28/3/00 and 6/3/00. (S.A.M., Nos. A 4105 and A 4312.)

Near to *S. subalatum*, but distinguished by the recurved tergal apex, the shape of the upper latus, and the curving of the non-projecting umbo of the inframedian latus under the rostral latus, instead of the projecting umbo being separated from the rostral latus by a wing-like expansion, as in *S. subalatum*.

Scalpellum agulhense n. sp.

(Plate I, fig. 8.)

This species is so close to *hendersoni* Pilsbry (1911, Proc. Ac. Nat. Sci. Philad., vol. lxiii, p. 172, fig. 1), from Florida Strait, that only the differences need be pointed out.

The upper latus has the angle between its carinal and carino-lateral margins more obtuse, so that the latter margin is more oblique with the former margin and the valve appears more triangular. Also the margin opposing the inframedian latus is horizontal and the upper end of this latter valve is less angular. The roof of the carina is convex but tricarinate, 1 keel being median and 2 lateral ; they are quite distinct, but rounded, and very prominent. The cuticle is rather thickly hirsute.

The 5 specimens show little variation : the margin of the upper latus abutting against the carinal latus is distinctly concave in 2, nearly straight in the other 3 specimens ; in 3 the rostrum tapers below and does not reach the basal angles of the rostral latus, in the other 2 it is nearly linear and extends the whole length of the ventral margin of the rostral latus.

Labrum subacutely produced.

Mandible with 3 teeth, outer margin of 2nd and 3rd with a few minute denticles, inner angle subacute, denticulate.

Maxilla with a notch separating the outer 4 unequal spines from the inner 6-7.

Outer maxilla rather sparsely setose.

First cirrus, rami subequal, both 7-jointed, not strongly expanded. Each joint of the other cirri with 5 pairs of setae increasing in length distally.

Caudal appendages $\frac{3}{4}$ length of peduncle of 6th cirrus, 1-jointed, tapering, apex subacute, setose.

No penis.

Male.—One in each scutal pouch. Oval, $\cdot 7 \times \cdot 4$ mm.; surface very minutely spinulose, antennae nearly at inner end, apex with 4 small valvules, 2 larger than the other 2, a trace of the degenerating cirri still visible.

Fourteen ova in an undifferentiated stage in the mantle cavity.

Length of capitulum, 5.5 mm.; of peduncle, 2 mm. *Breadth*, 3 mm.

Colour.—In spirit, white.

Locality.— $36^{\circ} 44' S.$, $21^{\circ} 14' E.$, 250 fathoms, 4 specimens on an Annelid tube with *S. cancellatum*; $34^{\circ} 27' S.$, $25^{\circ} 42' E.$ (off Cape Recife), 256 fathoms, 1 specimen on an Annelid tube. S.S. "Pieter Faure," 18/7/06 and 14/11/98. (S.A.M., Nos. A 3912 and A 4096.)

Scalpellum brachium-cancræ Welt.

(Plate I, fig. 10.)

1922. *Scalpellum brachium-cancræ*. Weltner, Wiss. Erg. Deutsch. Tiefsee Exp., vol. xxiii, pt. 2, p. 65, text-fig. 1, pl. ii, fig. 2.

Capitulum ovoid, apically rounded, with 14 slightly separated valves covered with an extremely fine cuticle, all the valves rather strongly striate radiately.

Scutum pentagonal, occludent margin slightly convex, lateral margin straight, apex acute, slightly recurved.

Tergum, occludent margin strongly convex, apex subacute, strongly recurved, not projecting much beyond carina.

Upper latus nearly rectangular, slightly wider than high, a rib slightly more prominent than the other striae, from umbo to basicarinal angle.

Carina simply and strongly arched, extending nearly to apex of tergum, umbo apical, sides narrow, at right angles to the roof, which is flat with a faint median rib, base quadrate.

Carinal latus triangular, umbo meeting its fellow below base of carina, but not prominent, basal and rostral margins subequal, the latter concave, apex rounded.

Inframedian latus curved, expanding upwards from an acute basal umbo, rostral margin concave, upper margin scalloped due to the striation.

Rostral latus small, basal and scutal margins subparallel, umbo not projecting.

Rostrum triangular, equilateral, widest at base.

Peduncle with 8 rows of 5 rather widely separated scales.

Labrum subacutely produced.

Mandible with 3 teeth, 1st far removed from and much larger than 2nd and 3rd, inner angle subacute, denticulate.

Maxilla with a notch separating the 3 outer unequal spines from the inner ones (ca. 10).

Outer maxilla oval, setose.

First cirrus, the 7-jointed posterior ramus longer than the 5-jointed anterior one, both rather strongly expanded and setose.

Each joint of the outer cirri with 4 pairs of long setae.

Caudal appendages nearly as long as peduncle of 6th cirrus, 1-jointed, with a thick apical tuft of setae.

No penis.

Male.—One in one of the scutal pouches, the other pouch empty. Oval, 5×3 mm., surface very minutely spinulose, antennae near inner end, apex with 4 subequal small oval valvules, testis distinct, no trace of cirri.

Cypris-larva.—About 2 dozen in the mantle cavity, of typical structure, yellowish, 75×5 mm.

The ♀ is preparing for another moult, as shown by the new cuticle within the old in the appendages.

Length of capitulum, 10 mm.; of peduncle, 4 mm. *Breadth*, 6.5 mm.

Colour.—In spirit, valves white, intervening membrane pinkish.

Locality.—Cape St. Blaize, N. by E. $\frac{1}{2}$ E., distant 68 miles, 105 fathoms, 1 specimen. S.S. "Pieter Faure," 21/2/02. (S.A.M., No. A 329.)

The "Pieter Faure" specimen is obviously identical with the "Valdivia" specimens described by Weltner. The plates, however, differ slightly in shape, and the scales of the peduncle are farther apart than in Weltner's figure. I have, therefore, thought it worth while to figure my specimen.

Weltner found his specimens on the backs of the crab *Scyramathia hertwigi* Dofl. captured on the Agulhas Bank at 250 fathoms. The S.A. Museum specimen is a detached specimen without any record as to the object on which it was found. I have examined all the

specimens of *Scyramathia* (and other crabs) in the museum collection, but have failed to find any more specimens.

It is curious to find barnacles on the back of *Scyramathia*, which seems to be invariably coated with a sponge (*Lissodendoryx*); and, indeed, the presence of this crab on the Agulhas Bank is exceptional. It was never taken east of Cape Point by the s.s. "Pieter Faure," but was found to be a characteristic species on the West coast.

Scalpellum porcellanum n. sp.

(Plate I, fig. 9.)

Capitulum ovate, both margins convex, with 14 closely fitting valves covered by an extremely thin cuticle, valves smooth or with very faint striae, growth-lines distinct.

Scutum trapezoidal, lateral margin straight, umbo slightly recurved.

Tergum large, triangular, ocludent margin convex, shorter than the other margins, apex subacute.

Upper latus quadrangular, nearly square, basal margin feebly biconcave.

Carina simply arched, umbo apical, base rounded, roof flat, bordered by slight acute ridges, a faint median ridge, sides narrow, at right angles to roof, concave, bordered by a ridge.

Carinal latus triangular, slightly wider than high, umbo somewhat projecting, rostral margin slightly concave.

Inframedian latus twice as high as its greatest width, which is near apex, slightly constricted above the basal umbo, scutal angle bevelled off.

Rostral latus twice as wide as high, umbo at upper angle of rostral margin. Rostrum extending whole length of rostral latera, narrow, widest above where it is rounded; in younger specimens nearly as wide across the top as long.

Peduncle incomplete.

Labrum subacutely produced.

Mandible with 3 teeth, 1st largest and farther from 2nd than 2nd from 3rd, outer margin of 2nd and 3rd minutely denticulate, inner angle subacute with 5-6 denticles; the 2nd tooth is absent on one of the mandibles of the specimen examined.

Maxilla with a distinct notch separating the outer 4 unequal spines from the inner ones.

Outer maxilla rather broadly ovate, moderately setose.

First cirrus, the 7-jointed posterior ramus longer than the 5-jointed anterior ramus, neither strongly expanded.

Each joint of the other cirri with 3 pairs of moderately long setae and a pair of setules below.

Caudal appendages $\frac{1}{2}$ length of peduncle of 6th cirrus, slender, 1-jointed, apex blunt with 3-4 setae.

No penis.

No male was found. The larger specimen appears still immature.

Length of capitulum, 4 mm. Breadth, 2 mm.

Colour.—In spirit, white.

Locality.—Cape Point, N.E. $\frac{1}{4}$ N., distant 18 miles, 135 fathoms, 2 specimens. S.S. "Pieter Faure," 27/2/02. (S.A.M., No. A 3925.)

Closely allied to *S. molliculum*, Pilsbry, 1911, and *laccadivicum* Annand., 1906. Under the latter, Annandale (1913) includes *subflavum* Annand., 1906, and *polymorphum* Hk., 1907. The present species is distinguished by the perfectly calcified valves, median ridge on the carina, greater prominence of the umbo of carinal latus, and by the well-developed rostrum.

Scalpellum brevicaulis n. sp.

(Plate I, fig. 11.)

Capitulum ovate, very stout basally, with 14 closely fitting valves covered by an extremely thin cuticle, all the valves rather strongly striate radiately, the margins of the valves being consequently crenulate.

Scutum trapezoidal, occludent margin slightly convex.

Tergum, occludent margin slightly convex, shorter than scutal margin, apex acute.

Upper latus subtriangular, only a slight angle between basal and carinal margins. -

Carina simply arched, umbo apical, sides moderately broad, roof striate, flat, between 2 prominent but rounded ribs, which reach farther down than the centre of the roof, the base being thus V-like incised.

Carinal latus of unusual form, V-shaped, the umbo at apex of V, not projecting very much beyond carina, the "outer arm" of the V forming a normally shaped valve, triangular, rostral margin straight, rather longer than basal margin, the "inner arm" growing into the excavate base of the carina where it meets its fellow, triangular,

striate like the rest of the valve ; in dorsal view the 2 valves look like a W and are of similar form to those of *S. parallelogramma* Hk., 1883.

Inframedian latus large, subquadrangular, sides slightly concave, apex broadly and somewhat obliquely rounded, umbo in middle of base, whence 2 slight ridges radiate to either side.

Rostral latus fully seen only in ventral view, subtriangular, rostral and basal margins confluent, upper inner angle far removed from upper latus.

Rostrum triangular, equilateral, widest at base.

Peduncle characteristic, very short, uppermost circle of plates consisting of 1 below, and of about the same width as, the carina, its carinal margin concave on either side of a median point, and 1 on either side meeting one another below the rostrum, all 3 plates vertically (in long axis of peduncle) striate ; the 2nd row also consisting of 3 plates in similar positions, but the lateral plates reach only half-way round the peduncle ; 3rd row similar, but the lateral plates extending still less round the sides ; below this is a 4th row of 2-3 irregular plates on the carinal side.

Labrum obtusely produced.

Mandible with 3 teeth, 1st largest, outer margin of 2nd and 3rd minutely denticulate, inner angle subacute, denticulate.

Maxilla, inner edge with a scarcely defined notch.

Outer maxilla ovate, setose.

First cirrus, rami subequal, the anterior 7-, the posterior 8-jointed, neither strongly expanded.

Each joint of the other cirri with 4 pairs of long setae, each with a short setule at base, and a pair of setules near base.

Caudal appendages $\frac{1}{2}$ length of peduncle of 6th cirrus, stout, apex subacute with 3 setae, margins extremely minutely spinulose.

No penis.

Male.—One in each scutal pouch. Oval, 4×2 mm., surface very minutely spinulose, antennae near inner end, no trace of valvules or cirri, testis distinct.

The larger specimen contained eggs in an early stage of segmentation. The smaller specimen contained 8 embryos in an early *Cypris*-stage. The antennae and the abdomen with its cirri are well developed, but the bivalve shell is not yet fully chitinised and is rather thick, its 2 component membranes still containing numerous (yolk ?) granules ; the embryos are still surrounded by the chorion and measure 4×25 mm.

Length of capitulum, 4 mm. ; of peduncle, .75 mm. *Breadth*, 2 mm.; basal width, side to side, 1.5 mm.

Colour.—In spirit, white.

Locality.—Algoa Bay, 36 fathoms, 2 specimens on a flabelliform calcareous Polyzoon. S.S. "Pieter Faure," 25/9/01. (S.A.M., No. A 3926.)

This species is closely allied to *S. parallelogramma* Hk., 1883, from the S. Atlantic, 600 fathoms, with which it shares the peculiarity of the V-shaped carinal latus. Hoek remarks that the valve appears as if "formed of 2 valves united together." It differs from this species, however, chiefly in size, in the rostrum, in all the valves being distinctly striate, and in the presence of scales on the peduncle. The arrangement of these latter is very curious.

Scalpellum eumitos n. sp.

(Plate I, fig. 12.)

Capitulum, occludent margin nearly straight, carinal margin strongly convex, with 14 closely fitting valves, covered by a pale yellowish cuticle with a short thick pile which becomes longer on the carina, all the valves radiately striate, the lines of growth moderately distinct; the striation, however, is somewhat variable; in the specimens on *Trochocyathus* it is quite strong on all the valves, but in those on *Dendrophyllia* it is very feeble, although traces of it are always to be found on the carina, carinal latera, and inframedian latera; where the striae are not visible, the growth-lines still retain indications of them by being irregularly crenulate or lamellate like the outside of an *Avicula* oyster. In young specimens 2 mm. long the valves are smooth.

Scutum pentagonal, basal and lateral margins subequal, but proportions variable, both sometimes slightly concave, margin abutting against inframedian latus always short.

Tergum, occludent margin straight, equal to or slightly shorter than scutal margin, apex acute.

Upper latus subtriangular, or more correctly pentagonal, the lower margin biconcave.

Carina simply but more or less strongly arched, umbo apical, sides moderately wide below, narrowing upwards, base rounded, roof convex with a narrow median groove between rounded ribs slightly more prominent than the other striae, intraparietes also striate.

Carinal latus triangular, carinal margin more or less strongly

concave, umbo projecting and meeting its fellow over base of carina, rostral margin concave.

Inframedian latus subquadrangular, umbo at basi-rostral angle, slightly narrowing apically.

Rostral latus triangular, wider than high, not meeting upper latus.

Rostrum small but distinct, subtriangular or subquadrate.

Peduncle with 10 rows of 7-8 closely imbricated scales, the intervening cuticle thickly clothed with long hairs.

Labrum acutely produced.

Mandible with 3 teeth, 1st largest, outer margin of 2nd and 3rd minutely denticulate, inner angle subacute, denticulate.

Maxilla, inner edge without a notch.

Outer maxilla somewhat quadrate, setose.

First cirrus, the 10-jointed posterior ramus longer than the 7-jointed anterior one, neither strongly expanded.

Each joint of the other cirri with 3 pairs of long setae and a pair of setules below them.

Caudal appendages $\frac{3}{4}$ length of peduncle of 6th cirrus, slender, 1-jointed, apically setose.

No penis.

Male.—One in each scutal pouch. Ovate, tapering a little posteriorly, 1 mm. \times 6 mm., surface minutely spinulose, antennae nearly at inner end, apex with 4 small oval valvules (2 slightly larger than the other 2), testis and muscle-fibres very distinct, no trace of cirri.

Larval Stages.—Some of the ♀♀ contained eggs in an early stage of segmentation, others contained embryos in an early *Cypris*-stage. The *Cypris*-shell still thick and full of (yolk) granules, antennae and abdomen with its cirri developed, still surrounded by the chorion, $\cdot 9 \times \cdot 6$ mm.

Length of capitulum, 10 mm.; of peduncle, 4 mm. *Breadth*, 5 mm.

Colour.—In spirit, valves white, cuticle yellowish.

Locality.—Vasco da Gama Peak, N. 71° E., distant 18 miles (off Cape Peninsula), 230 fathoms, 1 specimen on a *Trochocyathus* coral; Great Fish Point, N.W., distant 9 miles, 57 fathoms, 3 ad. and 6 juv. on a *Dendrophyllia* coral; Cape St. Blaize, N. by E. $\frac{1}{4}$ E., distant 67 miles, 90-100 fathoms, 4 specimens attached in pairs to the rims of two *Trochocyathus*, their ocludent margins inwards; Nanquas Peak, N. $\frac{3}{4}$ S., distant 21 miles (Algoa Bay), 63 fathoms, 1 on *Trochocyathus*.

S.S. "Pieter Faure," 4/5/00, 3/9/01, 22/12/99, and 23/9/01. (S.A.M., Nos. A 312, A 3909, A 4099, and A 4100.)

A somewhat variable species bearing some resemblance to *S. ornatum*, except in the shape of the carina.

Aberration.—A single specimen, No. A 3910 (Cape St. Blaize, N. by E. $\frac{1}{2}$ E., distant 68 miles, 105 fathoms. S.S. "Pieter Faure," 21/2/02), without data as to attachment, agrees in all respects with the typical form except in two or three points. In the typical form the upper latus is wider than high, the tergal margin being longer than the scutal margin, and the inframedian latus is higher than wide. In this specimen the upper latus is as high as wide, the tergal and scutal margins being equal, the carinal margin thus more oblique and slightly notched, the whole valve more triangular than in the typical form. The inframedian latus is also as high as wide and more triangular in shape. Scutum trapezoidal. All the valves are strongly striate.

A specimen from No. A 4099 is nearly intermediate between the last specimen and the typical form.

Further evidence that this specimen is only an aberrant form of *eumitos*, which has retained some of the youthful characters, is derived from a study of a long series of juvenile specimens. Most of these were taken from lot A 3909, but some of the other lots also provided specimens. It will be simplest to describe them according to size, beginning with the smallest and youngest stage. These stages must not, of course, be taken as corresponding with the stages between successive ecdyses.

A *Cypris*-larva, recently attached, measures 1 mm. \times 6 mm., and is nearly ready to cast off the *Cypris*-shell. The primordial scuta, terga, and carina are developed, and also the carinal latera and upper latera. Each of these latter plates is represented only by a minute circular point. Below them is another similar minute calcified point, which probably represents the inframedian latus as it is situated in the position later occupied by this valve. There are no traces of the rostral latera. It will be remembered, in connection with this last point, that in *Smilium pollicipedoides* the inframedian latus was the last valve to be formed.

The primordial valves have the same perforated structure as represented in Hoek's figure of the young of *S. stearnsi* (Siboga Exp. Monogr., 31A, pl. vi, figs. 11 and 12). Hoek does not describe the structure, but it seems to be exactly similar to that of the 2 larger valvules of the ♂ of *S. botellinae* n. sp., described below (p. 45).

The figures of the young Cirripede given by Darwin, Gruvel, and in MacBride's Text-book of Embryology, vol. i (to quote only those accessible to me), show the primordial valves as *reticulated*, but except in Darwin's Monograph no description is appended. Hoek's magnified fig. 12 is a very good representation of the structure, but the shading *within* the circles should have been omitted, as it gives them the appearance of shiny raised warts or granules instead of perforations. Krüger (1911, Beitr. Cirrip. Ostas., p. 20) speaks of these valves in *S. stearnsi* as "sieve-like."

Whether these primordial valves *at this stage* consist merely of chitin, as in Darwin's description, or are calcified, I am unable to say, as there is not enough material. They appear to be calcified, but later they certainly are impregnated with lime, though they still retain their porous nature and are clearly visible in a specimen of 7 mm. capitular length.

It will be seen that the above description differs from that given by Darwin for *Lepas australis* (Monogr. Cirrip. *Lepadidae*, p. 22; *Balanidae*, p. 129, pl. xxx, figs. 3, 3A).

The second stage measures 1.5 (total length) \times .6 mm.—Here the primordial valves have been considerably extended by non-porous additions. The upper latus is rectangular in shape, with the carinal-basal angle rounded off. The inframedian latus is oval. Carinal latus well-developed, but the rostral latus is only just beginning to be developed. Rostrum apparently absent, but as there is only 1 specimen in this stage, its presence or absence must be left undecided. Lateral and basal margins of the scutum confluent. A ring of 4 plates on the peduncle, close up under the capitulum; the one below the carinal latus projects outwards (dorsally) and downwards towards the point of attachment, and is longer than the lateral one below the inframedian latus (*cf.* Hoek's figure of the young of *S. stearnsi* in *loc. cit.*, pl. vi, fig. 11).

Third stage, from 1.5–2 mm. (total length).—Lateral and basal margins of scutum forming an angle slightly over 90°. Inframedian latus more quadrate, but wider below than apically, thus sometimes subtriangular. Rostral latus developed but scarcely bigger than the rostrum.

Fourth stage, from 2–3 mm.—Angle between the lateral and basal margins of the scutum bevelled off. Upper latus still with the tergal and scutal margins subequal; its basal-carinal angle bevelled off, straight or even slightly concave. Inframedian latus growing more rapidly above than below, the umbo consequently tending to approach

the base. Several rings of peduncular plates intercalated between the original 4 and the base of the capitulum.

Fifth stage, 3 mm. upwards.—The margin of the scutum abutting against the inframedian latus becomes more marked and the upper latus wider in proportion to its height.

Scalpellum uncinatum n. sp.

(Plate I, fig. 13.)

Capitulum of 14 more or less closely fitting valves covered by a thickish, yellow, glabrous cuticle, growth-lines quite distinct, occludent margin straight, carinal margin convex.

Scutum pentagonal, umbo slightly recurved, lateral and basal margins more or less concave, 2 very slight ridges diverging from umbo.

Tergum triangular, occludent margin shorter than basal margin, apex acute. Upper latus wider than high, quadrangular; basal margin slightly concave or biconcave, 1 or 2 ridges (if 2, close together) running from umbo to basi-carinal angle.

Carina simply but strongly arched, umbo apical or subapical, sides narrow, base rounded, roof flat between 2 prominent but rounded ribs.

Carinal latus triangular, rostral margin straight or slightly concave, carinal margin more or less concave, umbo more or less projecting, sometimes straight, sometimes distinctly hook-like.

Inframedian latus quadrangular, at least twice as high as wide, umbo at basi-rostral angle, sometimes rather prominent, with a more or less pronounced ridge from umbo to upper carinal angle, upper scutal angle sometimes bevelled off.

Rostral latus about as high as wide, but variable, scutal margin more or less convex, rostral margin very short, umbo acute.

Rostrum small, subtriangular or subquadrate.

Peduncle with 12 rows of about 10 rather closely imbricated scales.

Labrum subacutely produced.

Mandible with 3 teeth, 1st largest, 2nd and 3rd subequal, inner angle subacute, denticulate.

Maxilla, inner edge with a very slight and narrow notch.

Outer maxilla somewhat quadrate.

First cirrus, the posterior 8-jointed ramus longer than the 6-jointed anterior ramus, neither strongly expanded.

Each joint of the other cirri with 4 pairs of long setae, each with a setule at base, and a pair of short setae below.

Caudal appendages $\frac{1}{2}$ length of peduncle of 6th cirrus, short and stout, apex with 2 setae.

No penis.

Male.—One in each scutal pouch. Broadly oval, $.9 \times .6$ mm., surface minutely spinulose, antennae at inner end, apex with 4 rather large oval valvules, 2 a little larger than the other 2, no trace of cirri.

Cypris-larva.—About 15 specimens from one ♀, of typical structure, yellowish, 1 mm. \times .6 mm.

Length of capitulum, 6 mm. ; of peduncle, 4.5 mm. *Breadth*, 4 mm.

Colour.—In spirit, valves white, cuticle yellowish.

Locality.—Nanquas Peak, N. $\frac{3}{4}$ W., distant 21 miles (E. of Algoa Bay), 63 fathoms, 10 specimens on a Hydroid ; $32^{\circ} 45' S.$, $28^{\circ} 26' E.$ (off Cape Morgan), 36 fathoms, 2 specimens ; Glendower Beacon, N. $\frac{1}{2}$ W., distant 16 miles (off Port Alfred), 66 fathoms, 3 ad. and 5 juv. on a Hydroid ; Cape St. Francis, N.E. by E., distant 32 miles, 74 fathoms, 10 juv. on a Hydroid ; Umkomaas River, N.W. by W. $\frac{1}{2}$ W., distant 5 miles (Natal), 40 fathoms, 1 juv. ; Scottburgh, N.W. by N., distant 8 miles (Natal), 92 fathoms, 1 juv. S.S. "Pieter Faure," 23/9/01, 12/1/99, 10/9/01, 19/2/02, 31/12/00, and 7/3/01. (S.A.M., Nos. A 325, A 3907, A 4101, A 4102, A 4297, and A 4298.)

A variable species allied to *calcaratum* and *salartiae*.

Scalpellum natalense n. sp.

(Plate I, fig. 14.)

Capitulum with 14 closely fitting, smooth valves covered by a very thin cuticle, both margins convex.

Scutum trapezoidal, occludent margin convex, umbo acute, recurved, lateral margin straight.

Tergum triangular, occludent margin convex, apex acute.

Upper latus quadrangular, nearly square, carinal margin longer than scutal, basal margin excavate for apex of inframedian latus.

Carina simply arched, umbo apical, roof slightly concave between indistinct rounded borders, sides very narrow.

Carinal latus subquadrate, much higher than wide, umbo at base meeting its fellow below the carina, rostral margin straight.

Inframedian latus at least twice as high as wide, oblong, margins parallel, umbo at basi-rostral angle.

Rostral latus triangular, about as high as wide, no basal margin, umbo at upper end of rostral margin.

Rostrum as high as rostral latus, linear, slightly wider below, apex rounded.

Peduncle short, with 6 rows of 5 moderately closely imbricated scales. Labrum obtusely produced.

Mandible with 3 equidistant teeth, 1st slightly larger than 2nd and 3rd, outer margin of 3rd very minutely denticulate, inner angle subacute, minutely denticulated.

Maxilla, inner edge without a notch, but a gap between the 4 unequal outer spines and the inner ones.

Outer maxilla ovate, setose.

First cirrus, the 6-jointed posterior ramus slightly longer than the 5-jointed anterior ramus, neither strongly expanded, but rather densely setose.

Each joint of the other cirri with 3 pairs of long setae, 1 pair of shorter setae below these, and below these again 1 pair of setules.

Caudal appendages slender, $\frac{1}{2}$ length of peduncle of 6th cirrus, 1-jointed, apex subacute with 2 setae.

No penis.

Male.—One in a pouch under each scutum. Oval, .4 mm. \times .2 mm., surface very minutely spinulose, antennae near the inner end, apex with 4 subequal, minute roundish-oval valvules; testis distinct, no trace of cirri.

Cypris-larva.—12 specimens in the adult ♀, of typical form and structure, .6 mm. \times .3 mm., yellowish.

Length of capitulum, 3.5 mm.; of peduncle, 1 mm. *Breadth*, 1.75 mm.

Colour.—In spirit, white.

Locality.—Tugela River, N. by W. $\frac{3}{4}$ W., distant 21 miles (Natal), 79 fathoms, 1 ad. and 1 juv. on a Hydroid. S.S. "Pieter Faure," 9/1/01. (S.A.M., No. A 4104.)

Close to *S. valvulifer* in the shape of the upper and inframedian latera, but distinguished by the shape of the carina, rostral latus, and rostrum.

Scalpellum sinuatum Pilsbry.

1907. *Scalpellum sinuatum*. Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 50, fig. 16.

The identification of these specimens has caused me considerable difficulty, and other workers may differ from my conclusions.

An account of the peculiar features will be given first, so that the relationships may be better appreciated.

There are 6 specimens: 5 from one haul, designated here as (*a*), and 1 from another haul, approximately in the same locality, (*b*).

The inframedian latus in (*b*) and 2 specimens of (*a*) is hour-glass shaped, about equally wide above and below, the upper margin concave, touching the upper latus, one corner touching also the scutum, umbo in the middle of the constriction. In 2 others of (*a*) it narrows from the base upwards, ending in a blunt apex in contact with the upper latus; the 6th specimen (*b*) is similar to the last 2, but does not reach the upper latus. A microscopic examination shows, however, that in reality these subtriangular forms are hour-glass shaped with a median umbo, calcification having proceeded much more rapidly in the concave sides than at either end, thus obliterating the true shape when superficially examined. Thus this valve is variable in the ultimate shape it assumes, and the objection that we are here dealing with 2 separate species is shown to be invalid on this one ground alone, apart from other considerations.

The second point concerns the rostrum, which is also very variable. In 2 specimens (*a*), of capitulum length 6 and 5 mm., it is a small triangular rudiment at the top of the rostral latera; in one (*a*), length 7 mm., it is narrow, tapering basally, and separating the rostral latera only in their upper half; in (*b*) it is similar to the last, but separates the rostral latera in their upper three-quarters; lastly, in the other 2 (*a*), lengths 6.5 mm. and 4 mm., it is of nearly equal width throughout, but slightly larger at the upper end, and separates the rostral latera for their entire length. It will be seen that degree of development of the rostrum cannot be correlated with the size and, therefore, the age of the specimen. Nor is there any correlation between the variability of the rostrum and the inframedian latus. Thus, of the 3 specimens with an hour-glass shaped inframedian latus, one has a rudiment of a rostrum, another has the rostral latera separated for half their length, and the third has them completely separated.

In all other respects, with the exception of a reduction in the number of peduncular scales in the largest specimen, all the specimens are in perfect agreement with one another.

The series is interesting in showing the simultaneous variation in 2 valves, and also how easily there can be evolved a species permanently lacking a rostrum and with a strong tendency to eliminate the inframedian latera, thus becoming only 11-valved. There are already a large number of species in which the rostrum is entirely absent or rudimentary; and it is in the practical difficulty of separating these

two series that Gruvel's 1905 classification appears so artificial. A definite stage in the evolution of *Scalpellum* would seem to be indicated by the loss of the rostrum. The next stage is the elimination of the inframedian latera which is nearing fulfilment in several species of the group *Arcoscalpellum*, as remarked upon by Pilsbry (1908, Proc. Ac. Nat. Sci. Philad., vol. lx, p. 109).

At first sight these specimens bear an extraordinary likeness to *S. albatrossianum* Pilsbry (1907, *loc. cit.*, p. 54, fig. 19, and see Annandale, Illustr. Zool. Investigator, "Crust. Entomostr.," pl. iii, fig. 10), the only difference in the paired valves being the upper end of the inframedian latus (in the hour-glass form): here it is concave, whereas in *albatrossianum* it is convex. This is so slight a difference, especially in view of the above-mentioned variability, that it would not suffice to separate the two but for the presence of the rostrum in the Cape specimens.

This feature brings the specimen close to *sinuatum*, particularly to the young form figured by Pilsbry. This species has the upper end of the hour-glass-shaped inframedian latus concave, but, contrary to what is the case in the Cape specimens, the upper end is wider than the lower, especially in Pilsbry's larger specimen. As regards the rostrum, 2 of the Cape specimens present exactly the same appearance as shown in Pilsbry's figure.

In size, the largest of the present specimens corresponds exactly with Pilsbry's smaller specimen.

The only question is whether the sinus in the upper latus of the larger type-specimen is normal or not. And this must wait for an answer until more N. Atlantic specimens are obtained.

A comparison with *tenue* Hoek, 1883, shows that the Cape specimen, which most nearly resembles this species in the inframedian latus, has a fully developed rostrum, whereas *tenue* has only a mere rudiment.

On the whole, therefore, I think there is good reason for assigning these specimens to *sinuatum*.

The difficulties of identification are shown by the fact that in the explanation to pl. iii, fig. 10, of Illustr. Zool. Investigator, *S. tenue* Annandale (non Hoek) (Herdman's Ceylon Pearl Fish. Suppl. Rep., 31, p. 142) is made a synonym of *albatrossianum*, whereas in a later publication (1913, Rec. Ind. Mus., vol. ix, pt. 4, p. 230) it is made synonymous with *S. pacificum* Pilsbry, 1907.

Annandale thinks that this latter species is most closely related to *albatrossianum* and also with *novae-zealandiae* Hoek, 1883. Pilsbry,

in describing *albatrossianum*, also refers to the likeness with Hoek's species.

Thus there is a very closely allied group of species, which later may be regarded only as varieties or local forms of one. They are *tenue* Hk.; *albatrossianum* Pilsbry, 1907; *pacificum* Pilsbry, 1907; *woodmasoni* Annandale, 1906; *sinuatum* Pilsbry, 1907; *novae-zealandiae* Hk., 1883, and perhaps also a few other species such as *minutum* Hk., 1883, and *australicum* Hk., 1883.

Details of the appendages are as follows :—

Labrum bluntly produced.

Mandible with 3 teeth, a minute secondary tooth between 1st and 2nd varying in size on the two mandibles, inner angle acute, denticulate.

Maxilla, inner edge with a gap, but no notch, between the 4 unequal outer spines and the inner ones.

Outer maxilla ovate, setose "olfactory tubules" very long, reaching to apex of maxilla.

First cirrus, anterior ramus 6-jointed, posterior 8-jointed, subequal, joints expanded, almost moniliform, especially on the anterior ramus, setae on this latter ramus stout.

Each joint of the other cirri with 4 groups of 1 long seta and 1 short setule.

Caudal appendages equal to peduncle of 6th cirrus, 4-jointed, each joint with an apical seta.

No penis.

Male.—One in each scutal pouch. In one case 2 were found on the one side, both apparently in the same stage of development. Oval, .9 mm. \times .5 mm., surface very minutely spinulose. Antennae in the middle of one side, so that when detached the little animal resembles a mushroom in shape. No trace of any valvules or cirri. Testis and the criss-cross series of muscle-fibres very distinct.

Two of the specimens (6 mm.) contained a small number of ova in an undifferentiated stage of development.

Length of capitulum, 7 mm.; of peduncle, 2.5 mm. *Breadth*, 3 mm.

Colour.—In spirit, white.

Locality.—Cape Point, N.E. by E. $\frac{1}{4}$ E., distant 40 miles, 800–900 fathoms, 1 specimen; Cape Point, N. 86° E., distant 43 miles, 900–1000 fathoms, 5 specimens. S.S. "Pieter Faure," 14/7/03 and 19/8/03. (S.A.M., Nos. A 330 and A 331.)

Geogr. Distribution.—East Coast of N. America, 1731 fathoms (Pilsbry).

Scalpellum botellinae n. sp.

(Plate I, fig. 15.)

Capitulum ovate, both margins convex, with 14 closely fitting valves covered by a very fine cuticle, all the paired valves (except the inframedian latus) faintly striate radiately, the striae some little distance apart.

Scutum trapezoidal, lateral margin slightly convex, apical umbo acute, somewhat recurved, basal margin convex, a slight ridge more distinct than the other striae from apex to basi-lateral angle.

Tergum triangular, ocludent margin straight, much shorter than scutal, carinal margin excavate just below the acute apical umbo, ridge from umbo to basi-carinal angle very indistinct.

Upper latus trapezoidal, basal margin very short.

Carina simply arched, extending nearly to apex of tergum, umbo apical, roof flat between well-marked but rounded bordering ridges, base rounded quadrate, sides very narrow, without oblique grooves.

Carinal latus quadrangular, rostral margin angularly convex, umbo bluntly and shortly projecting beyond carina, not meeting its fellow, there being an inner extension of the valve which joins that of the other side below the base of the carina, very much as in *parallelogramma* and *brevicaulis*.

Inframedian latus subtriangular, scarcely higher than its basal width, umbo at the subacute apex, which meets the upper latus, sides concave. In the young the valve is more quadrangular, not having yet begun to expand at the base.

Rostral latus trapezoidal, twice as wide as high, basal margin slightly longer than rostral margin.

Rostrum distinct, rather stout, linear or dumb-bell shaped; in the young it is triangular, widest above and only separating the rostral latera in their upper half.

Peduncle short, with 8 rows of 4 closely imbricated scales.

Labrum obtusely produced.

Mandible with 4 teeth besides the inner angle, the 1st largest, inner angle acute, minutely denticulate. In 1 specimen both mandibles have a 5th well-developed tooth between the 1st and 2nd.

Maxilla, a very narrow gap separating the 4 outer unequal spines from the inner ones.

Outer maxilla broadly ovate, setose.

First cirrus, the 8-jointed posterior ramus slightly longer than the 7-jointed anterior ramus, neither strongly expanded but both rather densely setose.

Each joint of the other cirri with 3 pairs of long setae, 1 pair of shorter setae, and below these 1 pair of setules.

Caudal appendages entirely absent.

No penis.

Male.—One in each scutal pouch, very large in proportion to the size of the scutum, its inner end reaching almost to lateral margin of the valve. Oval, 1 mm. \times .6 mm., surface minutely spinulose, antennae near the inner end, apex turned inwards towards the other ♂, with 4 valvules, 2 of which are large, .2 mm. in diameter, roundish oval, the other 2 minute, no trace of cirri. The 2 larger valvules are perforated by a number of holes, appearing exactly like a tracheal "sieve-plate" in a plant, and resembling the structure of the primary valves described under *S. eumitos*, and figured for *S. stroemii* by Hoek (Siboga Exp. Monogr., 31A, pl. vi, figs. 11 and 12).

Cypris-larva.—Nine specimens in one ♀, of typical structure, 1 mm. \times .5 mm., yellowish.

Another ♀ specimen possesses in one scutal pouch a fully developed ♂ and in the other a *Cypris-larva*. The latter has crept in head foremost, as would be expected, and has not yet thrown off the *Cypris*-shell.

Length of capitulum, 4 mm.; of peduncle, .75 mm. *Breadth*, 2.5 mm.

Colour.—In spirit, white.

Locality.—Cape Natal, W. by N., distant 4 miles, 47 fathoms; same bearings, distant 6 miles, 54 fathoms. Several specimens on the arenaceous Rhizopod *Botellina pinnata* Pearcey. S.S. "Pieter Faure," 14/12/00. (S.A.M., Nos. A 4108, A 4109.)

This Rhizopod was found growing in enormous numbers in certain localities, forming the chief component of the bottom samples. Besides the *Scalpellum*, a sessile barnacle, solitary corals, an Alcyonarian, a compound Tunicate, Hydroids, Serpulae, and other worm-tubes were found using the *Botellina* as a support.

S. botellinae is closely allied to *S. vitreum* Hk., 1883, but differs chiefly in size and in having a larger inframedian latus, a lower rostral latus, a well-developed rostrum, and in lacking the lateral grooves on the carina.

Scalpellum micrum Pilsbry.

1907. *Scalpellum micrum*. Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 57, fig. 21.

One specimen nearly twice the size of the type affixed to a Hydroid, with a smaller specimen (capitulum, 4.5 mm.) attached to its peduncle. Both specimens agree with Pilsbry's description, except that the subearinal margin of the carinal latus is slightly convex instead of concave. The peduncle of the larger specimen differs from that of the type in that it is longer relatively to the length of the capitulum, and has rather wide bare spaces between the scales. When compressed, however, it appears exactly as in Pilsbry's figure, and like the type has 5 rows of 4 scales. Each scale has a few short hairs on its lower surface. This difference in the relative length of the peduncle is most probably due to the method of preservation.

Labrum strongly and subacutely produced.

Mandible with only 2 teeth besides inner angle, 1st farther from 2nd than 2nd from inner angle, the latter trifid in the one mandible, bifid in the other.

Maxilla, inner edge with a rather deep notch separating the outer 3-4 spines from the 7-8 inner ones, 1-2 fine setules in the notch.

Outer maxilla ovate, labial palp moderately slender, both setose.

First cirrus, the 6-jointed anterior ramus shorter and stouter than the 9-jointed posterior ramus.

Caudal appendages very minute, scarcely $\frac{1}{2}$ width of base of peduncle of 6th cirrus, 1-jointed, tipped with setae.

Penis absent.

Male.—One in a pouch under each scutum in the larger specimen, the smaller was not examined. Oval, .75 mm. \times .5 mm., surface with extremely minute spinules. No internal structure, except a not very distinct testis. No trace of any valvules at the apex.

The larger (♀) specimen contained a small number of eggs. These are .5 mm. \times .3 mm., and are in an early *Metanauplius* stage. At one end are 5 pairs of little buds, presumably incipient cirri, although it is very unusual for the posterior appendages to appear before the anterior ones. No trace of appendages at the other end can be perceived.

Length of capitulum, 9 mm.; of peduncle, 4.5 mm. *Breadth*, 4.5 mm.

Colour.—In spirit, white.

Locality.—East London, N.W. $\frac{1}{2}$ N., distant 20 miles, 400–450 fathoms, 2 specimens. S.S. “Pieter Faure,” 17/4/01. (S.A.M., No. A 3911.)

Geogr. Distribution.—Between Bahamas and Cape Fear, N. Atlantic, 294 fathoms (Pilsbry).

Scalpellum imperfectum Pilsbry.

1907. *Scalpellum imperfectum*. Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 75, fig. 30.

The single specimen agrees with Pilsbry's description and figure, except that the projection near the apex of the scutum is more acute—but not nearly so long and narrow as in *S. sanctaebarbarae* Pilsbry (*loc. cit.*, p. 77, fig. 31)—and the basal margin of the upper latus is slightly emarginate.

As remarked by Annandale (1913, Rec. Ind. Mus., vol. ix, pt. 4, p. 233), this species and *sanctaebarbarae* are very close to *gruveli* Annand., 1906, and may possibly be only varieties of the last-mentioned species. This author makes *S. chitinosum* Hoek, 1907, a synonym of *gruveli*. The differences between *gruveli*, *sanctaebarbarae*, and *chitinosum* are certainly very slight, but, on the other hand, *imperfectum* seems to stand somewhat apart as regards the shape of the scutal tooth.

Mouth-parts and appendages as described by Pilsbry.

Male.—Two in each scutal pouch. Oval, 1.3 mm. \times .75 mm., the surface rather thickly covered with small hairs. As in *gruveli*, the antennae are situate in the middle of one side. In other respects also there is scarcely any difference between these ♂♂ and those of the Indian Ocean species, as described by Stewart (1911, Mem. Ind. Mus., vol. iii, pt. 2).

Length of capitulum, 25 mm.; of peduncle, 11 mm. *Breadth*, 14 mm.

Colour.—In spirit, valves white, membrane pinkish.

Locality.—Cape Point, N.E. by E. $\frac{1}{4}$ E., distant 38 miles, 755 fathoms, 1 specimen. S.S. “Pieter Faure,” 24/6/03. (S.A.M., No. A 282.)

Geogr. Distribution.—East coast of N. America, 781–1230 fathoms (Pilsbry).

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 1851. *Lithotrya*. Darwin, Monogr. Cirrip., p. 332.
 1900. „ Borradaile, Proc. Zool. Soc. Lond., 1900, p. 798.
 1902. „ Gruvel, Arch. Mus. Paris (4) IV, fasc. 2.
 1903. „ Borradaile in Gardiner's F. Mald. and Laccad. Archip., vol. i, pt. 4.
 1905. „ Gruvel, Monogr. Cirrip., p. 96.
 1907. „ Hoek, Siboga Exp. Monogr., 31A, p. 122.
 1907. „ Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 6.
 1909. „ Gruvel, Tr. Linn. Soc. Lond., vol. xiii, pt. 1, pp. 23, 26.
 1912. „ Gruvel, Bull. Mus. Paris, No. 6, p. 347.

Lithotrya valentiana (Gray).

1825. *Conchotrya valentiana*. Gray, *loc. cit.*
 1857. *Lithotrya* „ Darwin, *loc. cit.*, p. 371, pl. viii, fig. 5.
 1905. „ „ Gruvel, *loc. cit.*, p. 101, fig. 113.
 1914. „ (*Conchotrya*) *valentiana*. Annandale, Rec. Ind. Mus., vol. x, pt. 5, p. 275.

Length of peduncle not much more than the length of the capitulum measured along rostral margin of scuta; upper row of scales quadrangular, contiguous, not serrate, lower edges overlapped by the next row, second and succeeding rows contiguous, overlapping the bases of the row above, scales subcircular, not serrate.

No basal cup; 1 specimen, 7 mm. long, shows the attachment to a lateral disc, but the burrows were unfortunately not preserved.

Valves divergent and truncate apically, apical and basal width equal; thin, semi-transparent, the ridges moniliform in appearance. Scuta fitting into a deep groove in the terga. Terga with a groove, shallow in the larger, but more marked and rectangular in the smaller specimens; internal growing surface of scuta and terga as figured by Darwin for *L. truncata*. The smaller specimens bear a distinct likeness to *valentiana*, and may serve to connect the two species as suggested

by Darwin. Carina with strong ridge internally, the angles in the younger specimens sharper, *i.e.* more rectangular, than in the older ones (again connecting *truncata* and *valentiana*); inner growing surface oblique to the long axis. Latera absent. Rostrum very narrow and short.

Caudal appendages $\frac{1}{2}$ length of 6th cirrus. Mandible with 6-7 denticles between 1st and 2nd teeth, and 4 between 2nd and 3rd teeth.

Length.—Up to 10 mm.

Colour.—Brownish, peduncle lighter, valves purplish within.

Locality.—Mozambique, November 1912 (K.H.B.), 4 specimens in coral rock at high-water mark. (S.A.M., No. A 2218.)

Geogr. Distribution.—Red Sea (Darwin), Zanzibar (Gruvel), Baluchistan (Annandale).

Fam. LEPADIDAE.

1857. *Lepadidae* (part). Darwin, Monogr. Cirrip., p. 8.

1905. *Pentaspidae*. Gruvel, Monogr. Cirrhip., p. 102.

1907. *Lepadinae* (subfam.). Pilsbry, Bull. U.S. Nat. Mus., No. 60, pp. 3, 4.

1909. *Lepadidae* (*Lepadinae*). Annandale, Mem. Ind. Mus., vol. ii, pt. 2, p. 63.

1911. „ Krüger, Beitr. Naturg. Ostas, p. 22.

Key to the South African genera.

1. Valves fully calcified, approximate.
 - a. Carina extending up between terga. One or more filamentary appendages at base of 1st cirrus. Caudal appendages smooth . . . *Lepas*.
 - b. Carina extending only to base of terga. No filamentary appendages. Caudal appendages spinose.
 - i. Carina with the sides narrow throughout . . . *Poecilasma*.
 - ii. Carina with the sides widening towards base . . . *Megalasma*.
2. Valves incompletely calcified, widely separated.
 - a. Valves 5 or sometimes apparently 7 (the scutum being divided into two parts). Carina ending below in a disc, cup, or fork. No filamentary appendages. Caudal appendages present . . . *Octolasmis*.
 - b. Valves 2-5, very small. Carina, when present, with upper and lower ends alike. With filamentary appendages. No caudal appendages

Conchoderma.

Gen. LEPAS Linn.

1758. *Lepas* (part). Linnaeus, Syst. Nat., ed. 10, p. 667.
 1851. „ Darwin, Monogr. Cirrip., p. 67.
 1905. „ Gruvel, Monogr. Cirrhip., p. 104.
 1906. „ Annandale, Spolia Zeylanica, vol. iii, p. 193.
 1907. „ Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 79.
 1909. „ Annandale, Mem. Ind. Mus., vol. ii, pt. 2, p. 72.
 1910. „ Stebbing, Gen. Cat. S.A. Crust., p. 563.

In the Museum collection there are specimens of two species not recorded in Stebbing's 1910 catalogue, both cosmopolitan:—

Lepas anserifera L., from Table Bay and Algoa Bay.

Lepas pectinata Darw., from Durban, on *Spirula* and *Janthina* shells.

Key to the South African species.

1. Carina terminating below in a fork, more or less distinctly developed. Valves not particularly thin.
 - a. Valves more or less strongly striate radiately, especially the terga.
 - i. Occludent margin of scutum arched, protuberant. Five filamentary appendages *anserifera* L.
 - ii. Occludent margin close to the ridge from umbo to apex. One filamentary appendage *pectinata* Darw.
 - b. Valves smooth or only faintly striate.
 - i. Carina not markedly separated from scuta.
 - α. An internal umbonal tooth on right scutum only *anatifera* L.
 - β. Both scuta with a tooth *australis* Darw.
 - ii. Carina more or less prominently separated from scuta.
 - α. Three filamentary appendages. Occludent margin convex. Terga not projecting ventrally *hilli* (Leach).
 - β. Two filamentary appendages. Occludent margin straight. Terga projecting ventrally *testudinata* Auriv.
2. Carina terminating below in a flat oblong external disc, umbo angularly projecting. Valves thin and papery *fascicularis*, E. and S.

Gen. POECILASMA Darwin.

1844. *Trilasmis*. Hind's, Voy. Sulphur. Mollusca.
 1848. *Anatifa*. Gray, Proc. Zool. Soc. Lond., 1848, p. 44.
 1851. *Poecilasma*. Darwin, Monogr. Cirrip., p. 99.
 1884. *Temnaspis*. Fischer, Bull. Soc. Zool. Fr., vol. ix, p. 357.
 1888. *Poecilasma*. Hoek, Challeng. Rep., vol. viii, p. 43.
 1894. „ Aurivillius, K. Sv. Vet. Ak. Handl., vol. xxvi, pt. 7, p. 9.
 1905. „ Gruvel, Monogr. Cirrhip., p. 113.

1907. *Poecilasma*. Hoek, Siboga Exp. Monogr., 31A, p. 3.
 1907. „ Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 82.
 1909. „ Annandale, Mem. Ind. Mus., vol. ii, pt. 2, p. 86.
 1911. „ Krüger, Beitr. Naturg. Ostas, p. 35.

Key to the South African species.

1. Capitulum compressed, narrow. Carina basally truncate . *kaempferi* Darw.
 2. Capitulum more or less bullate, broad. Carina ending below in a small embedded disc *crassa* (Gray).

Poecilasma kaempferi Darwin.

1857. *Poecilasma kaempferi*. Darwin, *loc. cit.*, p. 102, pl. ii, fig. 1.
 1851. „ *aurantia*. Darwin, *ibid.*, p. 105, pl. ii, fig. 2.
 1902. „ *kaempferi*. Gruvel, Zool. Travaill. Talisman. Cirrhip., p. 46, pl. iv, fig. 1.
 1907. „ *dubium*. Hoek, *loc. cit.*, p. 6, pl. i, figs. 2-4 ; pl. x, figs. 1, *a-d*.
 1907. „ *kaempferi*. Pilsbry, *loc. cit.*, p. 84, pl. v, figs. 10, 11 ; pl. vi, figs. 3-5.
 1907. „ „ subsp. *litum*. Pilsbry, *ibid.*, p. 85, pl. vi, figs. 1-2.
 1907. „ „ subsp. *novaeangliae*. Pilsbry, *ibid.*, p. 85, pl. vi, figs. 13-14.
 1907. „ *inaequilaterale*. Pilsbry, *ibid.*, p. 85, pl. vi, figs. 6-8, 11, 12.
 1909. „ *kaempferi*. Annandale, *loc. cit.*, p. 90, pl. vii, fig. 8, and Illustr. Zool. Investig., "Cr. Entomostr.," pl. iii, fig. 1 (1908).
 1911. „ „ Krüger, *loc. cit.*, p. 36.
 1911. „ „ var. *litum*. Krüger, *ibid.*, p. 36, pl. iii, figs. 24, 25 ; text-figs. 68-71.
 1911. „ „ var. *dubium*. Krüger, *ibid.*, p. 37, pl. iii, fig. 26 ; text-figs. 72-76.
 1922. „ „ var. *aurantium*. Weltner, Wiss. Erg. D. Tiefsee Exp., vol. xxiii, pt. 2, p. 79.

A large number of specimens with the capitulum ranging from 1.5 mm.-14 mm., all taken from a single specimen of *Geryon quinquedens*.

The majority resemble the form *litum* Pilsbry, with a strongly arcuate ocelludent margin. But a few are indistinguishable from

Pilsbry's figures of *inaequilaterale*. There are many stages from the perfectly equivalve to the strongly inequivalve form. The width (from side to side) also varies, but is never as great as in *P. crassa*. Consequently I consider *inaequilaterale* as only a variety or subspecies of *kaempferi*.

The surface sculpturing has the appearance of very fine wrinkling, the radial striae are never stronger than, though sometimes as strong as, the growth-lines.

One specimen is remarkable in that the umbones of the terga are much less prominent, approximating to those of *crassa*; and, moreover, in that the terga and scuta are completely fused, though the dividing suture can still be traced, and the apices of the scuta project beyond the occludent margin as small acute points.

Another specimen has very much reduced terga, and, consequently, the ratio of length to breadth is much greater. Both aberrant specimens are sculptured in the manner described above.

Cirri as described by Darwin.

Caudal appendages $\frac{1}{3}$ to nearly $\frac{1}{2}$ length of peduncle of 6th cirrus, apically setose.

Penis with a short stalk, then widening abruptly (but not so wide and stout as in *crassa*), tapering to a fine point, on which is situate a dense tuft of setae; the whole transversely rugulose and setose.

Locality.—Cape Point, E. by N., distant 29 miles, 250–300 fathoms, many specimens, together with *P. crassa* on *Geryon quinquedens*; Buffalo River, N., distant 15 miles, 310 fathoms, 4 specimens on *Jasus parkeri* Stebb. S.S. "Pieter Faure," 27/8/03 and 24/4/01. (S.A.M., Nos. A 3902 and A 3913.)

Geogr. Distribution.—Japan, on *Inachus kaempferi* (Darwin: *kaempferi*); Madeira, on *Homola cuvierii* (Darwin: *aurantia*); Cape Bojador, 410–782 metres, on *Echinoids* (Gruvel); Florida, 170 fathoms (Pilsbry: *litum*); East coast of N. America, 194 fathoms, on *Eupagurus politus* and *Lithodes agassizii* (Pilsbry: *novaeangliae*); East coast of N. America and Florida, 70–80 fathoms, on *Scyramathia crassa* (Pilsbry: *inaequilaterale*); 5° S. 132° E., 204–304 metres (Hoek); Gulf of Manaar, 775 metres (Annandale); Japan, on *Macrocheira kaempferi* and *Geryon trispinosus* (Krüger); Gt. Fish Bay, on *Geryon affinis* (Weltner).

Poecilasma crassa (Gray).

1848. *Anatifa crassa*. Gray, Proc. Zool. Soc. Lond., 1848, p. 44.

1851. *Poecilasma crassa*. Darwin, *loc. cit.*, p. 107, pl. ii, fig. 3.

1905. „ „ Gruvel, *loc. cit.*, p. 116, fig. 132.

1907. *Poecilasma inaequilaterale*, subsp. *breve*. Pilsbry, *loc. cit.*,
p. 87, pl. vi, figs. 9, 10.

1922. „ *crassa*. Weltner, *Wiss. Erg. D. Tiefsee Exp.*,
vol. xxiii, pt. 2, p. 78, pl. iv, fig. 17.

It is sometimes difficult to exclude the personal equation in matters of classification. In the description of the “Albatross” specimens of this genus, it seems to me that Pilsbry has been guilty of “false quantities” in separating *inaequilaterale* from *kaempferi* as a distinct species, while reducing *breve* to the rank of a subspecies of the former. Above, I have given reasons for regarding *inaequilaterale* as a variety of *kaempferi*; below, I offer reasons for uniting *breve* with *crassa*. Nilsson-Cantell (1921) unites both *inaequilaterale* and its variety *breve* with *kaempferi*.

Pilsbry had only 2 specimens, rather smaller than Darwin's, which are said to differ from *crassa* in the straight ocelludent margin. This appears to be a variable character depending largely on the degree of asymmetry in the valves. The other point which might be thought to separate the two is the absence of lobes or teeth at the base of the carina. This absence is only presumed, since Pilsbry states that *breve* is “similar to *inaequilaterale*.” Whether or not such lobes are present in Pilsbry's specimens, their size and degree of development is a variable character, as shown by the present specimens.

A large number of specimens, associated with *kaempferi* on the same specimen of *Geryon quinquedens*, ranging from 2 mm. to 20 mm. in capitulum length; the largest, therefore, being considerably greater than Darwin's specimens.

They agree with Darwin's description. The surface lacks the wrinkly appearance characteristic of *kaempferi* (at least the S. African specimens of *kaempferi*), and is quite smooth, except for the radial and concentric striae. These near the base of the scuta are about equally strong, but towards the tergal and carinal margins the radial striae become far more prominent. A low rounded ridge runs from umbo to the apex of the scutum, and the “narrow depressed fissure-like line” found by Darwin in one of his specimens is here characteristic of all specimens above 9 mm. capitulum length; in smaller specimens it is sometimes traceable as a very faint groove, sometimes not at all. When it becomes distinctly developed it causes an angular notch in the tergal margin, and, as Darwin recognised, evidently shows how the divided scuta of *fissa*, etc., have been evolved.

Cirri as described by Darwin.

Caudal appendages about $\frac{1}{2}$ length of peduncle of 6th cirrus, apically setose.

Penis moderately stout in its basal $\frac{1}{5}$, then suddenly widening to a width equal to length of 1st part, tapering gradually to a point on which is situated a dense tuft of setae; the whole penis has the appearance of a long narrow capitulum on a peduncle; it is transversely rugulose all over and setose towards the apex, the setae less numerous and shorter than in *kaempferi*.

Length of capitulum, 20 mm.; of peduncle, 10–13 mm. *Breadth*, 17 mm. *Width* (side to side), 12 mm.

Locality.—Cape Point, E. by N., distant 29 miles, 250–300 fathoms, many specimens, together with *P. kaempferi* on *Geryon quinquedens*. S.S. "Pieter Faure," 27/8/03. (S.A.M., No. A 3903.)

Geogr. Distribution.—Madeira, on *Homola cuvierii* (Darwin); Bohol, Philippine Islands (Gruvel); Azores, on *Cancer bellianus* (Gruvel); Gulf of Mexico, 463 fathoms, on *Bathyplox typhla* (Pilsbry: *breve*); Gt. Fish Bay, 12 fathoms (Weltner).

Gen. MEGALASMA Hoek.

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|-------|--------------------|--|
| 1883. | <i>Megalasma</i> . | Hoek, Challeng. Rep., vol. viii, p. 50. |
| 1907. | " | Hoek, Siboga Exp. Monogr., 31A, p. 30. |
| 1907. | " | Pilsbry, Bull. U.S. Fish. Commiss., vol. xxvi,
p. 183. |
| 1907. | " | Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 87. |
| 1907. | " | Pilsbry, Proc. Ac. Nat. Sci. Philad., vol. lix,
p. 408. |
| 1909. | " | Annandale, Mem. Ind. Mus., vol. ii, pt. 2, p. 95. |
| 1911. | " | Krüger, Beitr. Naturg. Ostas, p. 39. |

Key to the South African species.

1. Umbo at basal angle of scutum . . . (*Glyptelasma*) *carinatum* Hk.
2. Umbo above basal angle of scutum . . . (*Megalasma*) *minus* Annand.

Subgen. GLYPTELASMA Pilsbry, 1907.

Megalasma carinatum (Hoek).

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|-------|-------------------------------|--|
| 1883. | <i>Poecilasma carinatum</i> . | Hoek, <i>loc. cit.</i> , p. 44, pl. i, figs. 8–10;
pl. ii, fig. 1; pl. vii, figs. 6, 7. |
| 1905. | " | Gruvel, Monogr. Cirrhip., p. 115,
fig. 130. |
| 1907. | " | Hoek, Siboga Exp. Monogr., 31A,
p. 5, pl. i, fig. 1. |

1908. *Megalasma carinatum*. Calman, Ann. Mag. Nat. Hist., ser.9, vol. i, p. 401, text-figs. 1-3.

External characters as well as the mouth-parts, cirri, caudal appendages, and penis as described by Hoek. Owing to the condition of the specimens I can add nothing to Calman's account of the dorsal filamentous appendages.

It seems doubtful if *M. annandalei* Pilsbry, 1907, and *subcarinatum* Pilsbry, 1907, will prove to be distinct from this species.

Length of capitulum, 7.5 mm.; of peduncle, 2-3 mm. *Breadth*, 3.5 mm.

Colour.—White.

Locality.—Cape St. Francis, N.E., distant 29 miles, 75 fathoms, 1 specimen attached to *Octolasmis orthogonia*; East London, N.W. $\frac{1}{2}$ N., distant 20 miles, 400-450 fathoms, 3 specimens on a dead Gorgonian stem. S.S. "Pieter Faure," 19/2/02 and 17/4/01. (S.A.M., Nos. A 281 and A 3927.)

Geogr. Distribution.—West Indies, 390 fathoms, and Ascension Is., 420 fathoms (Hoek); off Cuba, 600-900 metres (Gruvel); East Indies, 828-1633 metres (Hoek); Japan (Nilsson-Cantell).

Subgen. MEGALASMA s.s.

Megalasma minus Annand.

1906. *Megalasma striatum*, subsp. *minus*. Annandale, Ann. Mag. Nat. Hist. (7), vol. xvii, p. 399.
1907. ,, ,, subsp. *minus*. Annandale, Illustr. Zool. Investig., "Cr. Entomotr.," pl. i, fig. 8.
1907. *Poecilasma bellum*. Pilsbry, Bull. Bur. Fish., vol. xxvi, p. 183, pl. iv, fig. 6.
1907. *Megalasma* ,, and *minus*. Pilsbry, Proc. Ac. Nat. Sci. Philad., vol. lix, p. 409, figs. 1-7.
1907. ,, *lineatum*. Hoek, Siboga Exp. Monogr., 31A, p. 31, pl. iv, figs. 1-8 (and footnote, p. 33, = *minus* Annand.).
1909. ,, *minus*. Annandale, Mem. Ind. Mus., vol. ii, pt. 2, p. 97.
1922. ,, ,, Broch, Vidensk. Medd. naturh. For., vol. lxxiii, p. 273, fig. 31.

The above synonymy follows Annandale, and is based on an examination of 18 specimens ranging in size from 2.5 to 15 mm., all taken off the same specimen of sea-urchin.

Externally the specimens resemble Hoek's figures of *lineatum*, but the ridge on the scutum from the umbo to the occludent margin is rather stronger. The scutum is exactly twice as high as wide. The carina in the smaller specimens agrees with the figures of *lineatum* and *minus* given by Hoek and Pilsbry respectively. But as the specimens get larger there is a gradual obliteration of the median projection in the basal margin and a rounding off of the basal angles, until in the largest specimens the carina is indistinguishable from that of *bellum*. The fact that Pilsbry found this difference in shape "equally pronounced" in comparing specimens of *minus* from the Andaman Islands with young specimens of equal size of *bellum* from the Hawaiian Islands would seem to be outweighed by the present comparison of specimens *all from the same locality*.

In the second place the smaller specimens have 3 pairs, the larger ones 4 pairs, of spines on the joints of the cirri.

Moreover, the development of the teeth in the mandibles is variable and represents all stages between *bellum* and *minus*. A small accessory denticle may also be developed between the 2nd and 3rd, and between the 3rd and 4th primary teeth.

From this it appears that *bellum* and *minus* should be united.

The penis tapers gradually to a not very acute apex and is transversely rugulose and sparsely setose.

Length of capitulum, 15 mm.; of peduncle, 1-2 mm. *Breadth*, 5.5 mm.

Colour.—In spirit, white.

Locality.—S. Africa, label with the exact locality lost, 18 specimens attached to spines of a *Porocidar* sp. S.S. "Pieter Faure." (S.A.M., No. A 314.)

Geogr. Distribution.—Andaman Sea, 290-775 metres (Annandale : *minus*); Hawaiian Islands (Pilsbry : *bellum*); 5° 3' S., 119° E., 450 metres (Hoek : *lineatum*); Bay of Bengal (Annandale).

Gen. OCTOLASMIS (Gray).

1825. *Octolasmis*. Gray, Ann. Philos., vol. x, p. 100.

1851. *Dichelaspis*. Darwin, Monogr. Cirrip., p. 115.

1869. *Parodolepas*. MacDonald, Proc. Zool. Soc., 1869, p. 442.

1894. *Trichelaspis*. Stebbing, Ann. Mag. Nat. Hist. (6), vol. xiii, p. 443.

1894. *Dichelaspis*. Aurivillius, K. Sv. Vet. Ak. Handl., vol. xxvi, No. 7, p. 15.

1905. „ Gruvel, Monogr. Cirrhip., p. 123.

1907. *Dichelaspis*. Hoek, Siboga Exp. Monogr., 31A, p. 16.
 1907. *Octolasmis*. Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 93.
 1909. *Dichelaspis*. Annandale, Mem. Ind. Mus., vol. ii, pt. 2, p. 98.
 1910. *Octolasmis*. Stebbing, Gen. Cat. S.A. Crust., p. 564.
 1911. „ Krüger, Beitr. Cirrip. Ostas, p. 39.

Key to the South African species.

I. Five valves.

- A. Valves well developed, nearly completely covering the capitulum
tridens (Aur.).

B. Valves more or less reduced, leaving bare spaces.

- | | |
|---|------------------------|
| 1. Basal branch of scutum large | <i>warwicki</i> Gray. |
| 2. Basal branch of scutum very narrow. | |
| <i>a.</i> Tergum well developed, tridentate | <i>weberi</i> (Hk.). |
| <i>b.</i> Tergum very small, semicircular | <i>neptuni</i> (Mac.). |

II. Three valves (terga absent) *cor* (Aur.).

Octolasmis tridens (Auriv.).

- | | |
|------------------------------------|--|
| 1894. <i>Poecilasma tridens</i> . | Aurivillius, <i>loc. cit.</i> , p. 14, pl. i, fig. 13. |
| 1902. <i>Dichelaspis occlusa</i> . | Lanchester, Proc. Zool. Soc. Lond., 1902,
ii, p. 373, pl. xxxv, figs. 6-6c. |
| 1905. <i>Poecilasma tridens</i> . | Gruvel, Monogr. Cirrhip., p. 117, fig. 133. |
| 1905. <i>Dichelaspis occlusa</i> . | Gruvel, <i>ibid.</i> , p. 139, fig. 165. |
| 1909. „ <i>tridens</i> . | Annandale, <i>loc. cit.</i> , p. 107, pl. vii,
figs. 1, 2. |
| 1922. <i>Poecilasma</i> „ | Weltner, Wiss. Erg. D. Tiefsee Exp.,
vol. xxiii, pt. 2, p. 80, pl. iv, fig. 18. |

This species forms the transition from the genus *Poecilasma* to the present genus.

Two specimens resembling most nearly Annandale's fig. 1.

Length of capitulum, 3 mm. ; of peduncle, 5 mm. *Breadth*, 2.5 mm.

Colour.—White, the thin cuticle covering the valves pale brown, peduncle translucent.

Locality.—Durban, 8 specimens on gills of *Scylla serrata* together with *O. cor* (K. H. B.). (S.A.M., No. A 4302.)

Geogr. Distribution.—Philippines (Aurivillius); Malay Archipelago (Lanchester); N. Sumatra, Bay of Bengal (Annandale). On *Macroptthalmus tomentosus*, mouth-parts of *Thenus orientalis*, gills of *Calappa exanthematos*, base of chelae of *Xantho scaberrimus*. See Annandale, *loc. cit.*, 1909, p. 105.

Octolasmis cor (Auriv.).

1892. *Dichelaspis cor*. Aurivillius, Ofr. K. Sv. Vet. Ak. Forhl., No. 3, p. 124.
 1894. „ „ Aurivillius, *loc. cit.*, p. 20, pl. ii, figs. 1, 2.
 1902. „ *maindroni*. Gruvel, Arch. Mus. Paris, (4) iv, p. 282, pl. iv, figs. 21–27; pl. i, figs. 15, 16.
 1902. „ *coutierei*. Gruvel, *ibid.*, p. 289, pl. iv, figs. 28–32.
 1908. „ „ Annandale, Illustr. Zool. Investig., “Crust. Entomostr.,” pl. iv, figs. 4, 5.
 1909. „ *cor*. Annandale, *loc. cit.*, p. 119, pl. vi, figs. 7–10.
 1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 565.

The specimens vary greatly in the shape of the basal portion of the scutum as shown in Annandale's figures (and also in those of *maindroni* given by Gruvel in 1905, Monogr. Cirrhip., p. 135, figs. 157, A–C).

Caudal appendages slightly exceeding the peduncle of 6th cirrus. Penis exceedingly swollen (perhaps due to undischarged spermatozoa), apex pointed with a tuft of setules, whole surface transversely sculptured but scarcely rugulose, near the apex some short setules and widely spaced little short recurved spinules.

Length of capitulum, 5 mm.; of peduncle, up to 12 mm. *Breadth*, 4 mm.

Colour.—In spirit, yellowish, the little chitinous granules dark brown; when fresh valves white, chitinous parts and peduncle slate colour, resembling that of the crab's gills.

Locality.—Kowie, 5 specimens on “gills of a crab”; Durban, numerous specimens on gills of *Scylla serrata* (K. H. B.). (S.A.M., Nos. A 275, A 4301.)

Geogr. Distribution.—Port Natal and Java (Aurivillius); East coast of Africa, Persian Gulf, Bay of Bengal, Sumatra (Gruvel). On gills of *Panulirus* sp. (Gruvel), *Scylla serrata* (Annandale). See also Annandale, *loc. cit.*, 1909, p. 106.

Octolasmis warwicki Gray.

1825. *Octolasmis warwicki*. Gray, *loc. cit.*, p. 100.
 1830. „ „ Gray, Spicil. Zool., pl. vi, fig. 16.
 1851. *Dichelaspis* „ Darwin, *loc. cit.*, p. 120, pl. ii, figs. 6, 6a, 6b.

1894. *Dichelaspis warwicki*. Aurivillius, *loc. cit.*, p. 15, pl. viii, figs. 26, 27.
1902. „ *equina*. Lanchester, Proc. Zool. Soc. Lond., 1902, pt. 2, p. 385, pl. xxxv, figs. 7, 7a-d.
1906. „ „ Annandale in Herdman's Ceylon Pearl Fish. Suppl. Rep., 31, p. 139, fig. 2.
1908. „ „ Annandale, Illustr. Zool. Investig., "Cr. Entomostr.," pl. v, figs. 4-6.
1909. „ *warwicki*. Annandale, *loc. cit.*, p. 110.

The caudal appendages, as stated by Aurivillius, increase in length proportionally to the peduncles of the 6th cirri as the individual gets older until they are of the length same as these. Also the number of groups of bristles in the joints of the cirri increases with age.

The shape of the basal portion of the scutum also seems to vary with age as described by Aurivillius. The terga in all the specimens have only 2 teeth.

The smallest specimen I have seen measures 1 mm., and has a distinct capitulum and peduncle with the valves already of the characteristic shape, both portions of the scutum being developed.

The *Cypris*-stage measures .75 mm. in length.

Penis very stout, distally tapering rapidly to a point, the distal quarter being recurved towards the ventral side, distal portion with long scattered setae and a tuft of setae on the apex, whole surface with very fine and regularly arranged transverse rugulae. No delicate terminal process, as mentioned by Annandale (*loc. cit.*, 1919, p. 111), was found.

Length of capitulum, 9 mm.; of peduncle, 10 mm. *Breadth*, 6 mm.

Colour.—In spirit, valves white, membrane pinkish.

Locality.—Tugela River, N. by W., distant 5 miles (Natal), 25 fathoms, several specimens on *Lupa sanguinolenta*; Amatikulu River, N.W. by W., distant 12 miles, 23 fathoms, several small specimens on the ventral surface and edges of antennae of *Thenus orientalis*. S.S. "Pieter Faure," 22/1/01 and 7/2/01. Durban, several specimens on *Scylla serrata* (K. H. B.). (S.A.M., Nos. A 310, A 4304, A 4305.)

Geogr. Distribution.—Widely distributed over the whole of the Indian Ocean. On Decapod Crustacea, Mollusca, Sea-snakes, Fishes, Antipatharians, *Limulus*. (See Annandale, *loc. cit.*, 1909, p. 105.)

Octolasmis weberi (Hk.).

1907. *Dichelaspis weberi*. Hoek, Siboga Exp. Monogr., 31A, p. 26, pl. iii, figs. 2-7.

On a preliminary examination I put these specimens into *O. orthogonia* (Darw.). But as Hoek has relied on the size and the shape of the terga and carinal disc for distinguishing his species from Darwin's, and as these specimens agree with *weberi* in the characters mentioned, I have decided to identify them with Hoek's species.

As regards size, these specimens are considerably larger even than Hoek's specimens of *weberi*, and consequently very much longer than *orthogonia*.

The 3 specimens are attached to what appears to be a slender Echinoderm spine about 15 mm. long. The peduncles are attached at one end, but the cement is decurrent to the other end, so that the spine is completely concealed and the 3 peduncles fused into one. The occludent margins are turned inwards to face one another.

Penis stout, of equal width throughout, apically blunt and setose, with a curved finger-like process, apically setulose, at the end of which open the united vasa deferentia. This presumably resembles the process described by Annandale (*loc. cit.*, 1909, p. 111) in *O. warwicki*, and which he thinks may be retractile.

Length of capitulum, 15 mm. ; of peduncle, 8 mm. *Breadth*, 9 mm.

Colour.—In spirit, valves white, membrane and peduncle pinkish.

Locality.—Cape St. Francis, N.E., distant 29 miles, 75 fathoms, 3 specimens. S.S. "Pieter Faure," 12/2/02. (S.A.M., No. A 280.)

Geogr. Distribution.—Malay Archipelago, 560 metres (Hoek).

Octolasmis neptuni (Macdonald).

1869. *Parodolepas neptuni*. Macdonald, Proc. Zool. Soc. Lond., 1869, p. 442, pls. xxxiii, xxxiv.

1905. *Dichelaspis* ,, Gruvel, Monogr. Cirrhip., p. 127, fig. 147.

Half a dozen specimens agreeing with Macdonald's description and figure. Although the present material only allows a comparison with *neptuni*, I feel certain that a larger series would necessitate *sinuata* Auriv., *trigona* Auriv., and *vaillantii* Gruvel, becoming synonyms.

Annandale has already united these last two with *sinuata* (1909, *loc. cit.*, p. 121), and remarked on the nearness of *sinuata*, *mülleri*

Coker, *aymonini* Lesson to one another and to *lowei* Darwin. In fact, Darwin's name will probably be made to cover all the other species mentioned above, including also *darwini* Filippi.

The concentric lines shown in Macdonald's figure are constant in all the present specimens.

Length of capitulum, 2 mm. ; of peduncle, 4 mm. *Breadth*, 1.5 mm.

Colour.—Translucent white.

Locality.—Durban, 7 specimens on the gills of *Scylla serrata*, together with *O. tridens* and *cor* (K. H. B.). (S.A.M., No. A 4303.)

Geogr. Distribution.—Australia and ? Fiji, on gills of *Neptunus pelagicus* (Macdonald).

Gen. CONCHODERMA Olfers.

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| 1814 ?. | <i>Conchoderma</i> . | Olfers, Mag. Ges. Naturf. Fr. Berlin, viii (1818), 3rd Quart. (dated 1814), p. 177. |
| 1851. | " | Darwin, Monogr. Cirrip., p. 136. |
| 1905. | " | Gruvel, Monogr. Cirrhip., p. 143. |
| 1907. | " | Pilsbry, Bull. U.S. Nat. Mus., No. 60, p. 98. |
| 1909. | " | Annandale, Mem. Ind. Mus., vol. ii, pt. 2, p. 79. |
| 1910. | " | Stebbing, Gen. Cat. S.A. Crust., p. 565. |
| 1911. | " | Krüger, Beitr. Cirrip. Ostas, p. 26 (Synonyms). |

Key to the South African species.

1. Scutum bilobed. Tergum rudimentary or absent. Fleshy "ears" at apex of capitulum *auritum* L.
2. Scutum trilobed. Tergum distinct. No "ears" *virgatum* Spengler.

With regard to *C. auritum*, Pilsbry gives some notes on the colour and also coloured figures of Siberian specimens in Bull. Bur. Fish., vol. xxix, p. 71, pl. viii, figs. 5-7, 1911.

Both these barnacles grow attached to ships' bottoms, buoys, and the sessile barnacles (*Coronula*) on whales and turtles. They are never attached directly to the skin of these animals (see *Xenobalanus*).

An exception to this latter statement is found in the case of a small group of *virgatum*, together with young examples of *auritum*, which was taken off the tail of a large eel (*Gymothorax favagineus*) caught at the Kowie. (S.A.M., No. A 4318.)

Fam. ALEPADIDAE.

1851. *Lepadidae* (part). Darwin, Monogr. Cirrip., p. 8.
 1905. *Anaspidae*. Gruvel, Monogr. Cirrip., p. 157.
 1907. *Alepadinae* (subfam.). Pilsbry, Bull. U.S. Nat. Mus., No. 60,
 pp. 3, 4.
 1909. *Lepadidae* (*Lepadinae*). Annandale, Mem. Ind. Mus., vol. ii,
 No. 2, p. 64.
 1911. „ „ Krüger, Beitr. Cirrip. Ostas, p. 22.

Gen. HETERALEPAS Pilsbry.

1851. *Alepas* (part). Darwin, *loc. cit.*, p. 156.
 1907. *Heteralepas*. Pilsbry, *loc. cit.*, p. 100.
 1909. „ Annandale, *loc. cit.*, p. 83.
 1911. „ Krüger, *loc. cit.*, p. 29.
 1922. „ Broch, Vidensk. Medd. Naturh. For., vol. lxxiii,
 p. 279.

Krüger gives a list of the known species, distributing them among the 2 subgenera recognised by Pilsbry: *Heteralepas* s.s. and *Paralepas* Pilsbry, 1907. He places *lithotryae* Hk., 1907, and *morula* Hk., 1907, in *Heteralepas*, although Hoek expressly states that in *morula* the inner rami of 5th and 6th cirri are “as strongly developed as the outer rami,” and in *lithotryae* as in *intermedia* the inner rami are “slightly shorter” than the outer rami. Consequently I think *lithotryae* and *morula*, although in the latter the cirri are “long,” should more properly be assigned to *Paralepas*.

Heteralepas (*Paralepas*) *palinuri* n. sp.

Capitulum distinct from peduncle, ovate, dorsal (carinal) margin convex, rounded, without crest or keel, ventral margin less convex, orifice not protuberant or tubular, narrow, not crenulate.

Scuta absent, but their position marked by smooth patches. Surface smooth, with a few quite irregularly arranged wrinkles, probably due to method of preservation.

Peduncle long, narrow, cylindrical, not swollen below capitulum, not ringed, smooth.

Labrum with somewhat irregular teeth in the middle part of the crest, the lateral portions with feeble and obscure denticulations. Palps not meeting in middle, not very strongly setose.

Mandible with 4 sharp, entire, equal teeth (incl. the inner angle),

the lower margin of all set with a few small spinules, the interval between 1st and 2nd only slightly greater than the other intervals.

Maxilla with a conspicuous notch, the outer part with 2 strong unequal spines and a few spinules, the inner part with 2 strong spines (in the left, in the right maxilla only 1 is present), separated by a little notch, and numerous spinules.

Outer maxilla quadrate, with rounded angles.

Cirri short, very little curved, peduncles rather long, 5th and 6th not shorter than the preceding, rami of 5th and 6th cirri equally developed.

First cirrus, both rami 6-jointed, anterior slightly the longer, both with plumose setae.

Second and third cirri, outer ramus 14-, inner 13-jointed.

Fourth and fifth cirri, outer ramus 15-, inner 14-jointed.

Sixth cirrus, outer ramus 16-, inner 15-jointed.

Second to sixth cirri with a dense brush of short bristles on the anterior, 6 strong spines on the posterior apical margin of each joint.

Caudal appendages slender, 7-jointed.

Penis extending to end of 6th cirrus, tapering gradually, apex entire, subacute, distinctly ringed throughout, finely setose distally.

Length of capitulum, 22 mm.; of peduncle, 18 mm. *Breadth*, 15 mm.

Colour.—Alive, bright orange; in spirit, dirty white.

Locality.—Mozambique, November 1912 (K. H. B.), one ovigerous specimen attached to the buccal region of a *Panulirus* caught at low tide. (S.A.M., No. A 2223.)

SESSILIA.

Key to the South African families and subfamilies.

- I. Rostrum with radii. Labrum notched in the middle . . . *Balanidae*.
 1. Opercular valves together as large as orifice, scutum and tergum articulated together s.f. *Balaninae*.
 2. Opercular valves together not nearly as large as orifice. Basis membranous. Compartments, 6.
 - a. Rostrum divided into 3 by fine sutures visible within. Walls very thick. On turtles, crabs, manatees . . . s.f. *Chelonibiinae*.
 - b. Rostrum undivided. Walls thin with deep folds. Scutum and tergum not articulated together. Sometimes absent. On Cetacea (non-South African species also on turtles, manatees, sea-snakes and fishes) s.f. *Coronulinae*.

- II. Rostrum with alae, or when united with the rostral latera the composite compartment has overlapping lateral borders. Labrum concave, not notched *Chthamalidae*.

No representative of the *Verrucidae* has yet been reported from South Africa.

Fam. BALANIDAE.

1854. *Balanidae*. Darwin, Monogr. Balanid., p. 33.
 1905. *Balaninae*. Gruvel, Monogr. Cirrhip., p. 209.
 1911. „ Krüger, Beitr. Cirrip. Ostas, p. 46.
 1916. *Balanidae*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, pp. 47, 48.
 1922. „ Broch, Vidensk. Medd. Naturh. For., vol. lxxiii, p. 309.

Subfam. BALANINAE.

1854. *Balaninae*. Darwin, *loc. cit.*, p. 175.
 1916. „ Pilsbry, *loc. cit.*, p. 49.

Key to the South African genera.

1. Compartments, 6.
 a. Usually not spongiculous. Base usually flat. Compartments often stout, usually strongly connected *Balanus*.
 b. Spongiculous. Base cup-shaped or flat. Compartments thin, not porous, weakly connected *Acasta*.
 2. Compartments, 4 *Tetracrita*.

As noted below under the genus *Acasta*, there are no definite criteria by which *Acasta* can be separated from *Balanus*.

Gen. BALANUS da Costa.

1778. *Balanus*. da Costa, Hist. Nat. Test. Brit., p. 248.
 1854. „ Darwin, *loc. cit.*, p. 177.
 1910. „ Stebbing, Gen. Cat. S.A. Crust., p. 567.
 1913. „ Hoek, Siboga Exp. Monogr., 31B, p. 150.
 1916. „ Pilsbry, *loc. cit.*, p. 49.
 1921. „ Nilsson-Cantell, Zool. Bidrag. Upsala, vol. vii, p. 306.
 1922. „ Broch, *loc. cit.*, p. 309.

Key to the South African subgenera and species.

- I. Basis normally flat and attached throughout, not boat-shaped.
 1. Parietes permeated with pores.
 - a. Radii well developed, permeated with pores . . . s.g. *Megabalanus*.
 - i. Apex of tergum acute but not beak-like.
 - a. Usually large. Basal margin of scutum less than height
tintinnabulum L.
 - β. Small. Basal margin of scutum greater than height
algicola Pilsbry.
 - ii. Apex of tergum produced, beak-like . . . *maxillaris* Gron.
 - b. Radii not porous, rarely wanting . . . s.g. *Eubalanus*.
 - i. Scutum with 1 or more longitudinal rows of pits. Tergum without groove . . . *trigonus* Darw.
 - ii. Scutum without pits, but distinctly striate longitudinally
spongicola Brown.
 - iii. Scutum without pits and not striate or only very indistinctly so.
 - a. Scutum with well-developed adductor ridge . *amphitrite* Darw.
 - β. Scutum without (or with extremely feeble) adductor ridge.
 - * Basis not porous. White . . . **crenatus* Brug.
 - ** Basis porous. Speckled and streaked with pink
poecilotheca Krüger.
 2. Parietes not porous.
 - a. Basis calcareous.
 - i. Scutum ridged between adductor scar and high articular ridge.
Tergum without external furrow
s.g. *Hesperibalanus elizabethae* n. sp.
 - ii. Scutum not ridged. Tergum with external furrow or spur fasciole
s.g. *Chirona tenuis* Hk.
 - b. Basis membranous . . . s.g. *Membranobalanus orcutti* Pilsbry.
- II. Basis boat-shaped, only a small part attached . . . s.g. *Conopea*.
 1. Parietes porous . . . **calceolus* Darw.
 2. Parietes not porous. Adult greatly elongate, but neither rostrum nor carina touching the substratum . . . *scandens* Pilsbry.

Subgen. MEGABALANUS Hk.

1854. *Balanus* (sect. A.). Darwin, *loc. cit.*, p. 194.
 1913. *Megabalanus*. Hoek, *loc. cit.*, p. 158.
 1916. „ Pilsbry, *loc. cit.*, p. 51.

Balanus tintinnabulum (Linn.).

1758. *Lepas tintinnabulum*. Linnaeus, Syst. Nat., ed. 10, p. 668.
 1854. *Balanus* „ Darwin, Monogr. Balanid., p. 194,
 pl. i, figs. a-l; pl. ii, figs. 1, a-l, o.

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| 1897. | <i>Balanus tintinnabulum.</i> | Weltner, Arch. Naturg., p. 260. |
| 1905. | „ „ | Gruvel, Monogr. Cirrhip., p. 211,
figs. 230–231. |
| 1910. | „ „ | Stebbing, Gen. Cat. S.A. Crust.,
p. 567. |
| 1913. | „ „ | Hoek, Siboga Exp. Monogr., 31B,
p. 164, pl. xiv, figs. 5, 7 ; pl. xvi,
figs. 16–19 (with new varieties). |
| 1916. | „ „ | Pilsbry, Bull. U.S. Nat. Mus.,
No. 93, p. 54, pl. x, figs. 1, 1e,
2, 3 ; pl. xi, figs. 1, 1e, 2, 2e ;
pl. xii, figs. 1, 1b, 2, 2b ; pl. xiii,
figs. 1–2e ; pl. xiv, figs. 1–3 ;
pl. xv, figs. 1–2d, 4 ; pl. xvi,
figs. 1, 1a, 2, 2a, 3 ; pl. xvii,
figs. 5–8 ; text-figs. 8–11 (with
new subspecies). |

This species is cosmopolitan in distribution.

The following varieties are recorded from South Africa :—

var. *communis* Darwin.

(Pilsbry styles this form *B. tintinnabulum tintinnabulum* on the ground that *communis* was preoccupied.)

Small thin-shelled specimens from the bottom of the s.s. "Pieter Faure." White or pinkish, striped with darker pink, radii white or pink, scutum with a pink stripe. Specimens 10 mm. in height and 8 mm. basal diameter are stated to be "three months' growth." (S.A.M., Nos. A 291, A 294.)

Large typical specimens off a ship from the Cameroons, previously from Europe, berthed and cleaned at Cape Town. (S.A.M., No. 327.)

var. *zebra* Darwin.

Recorded from Walfish Bay, S.W. Africa, by Weltner.

A few specimens of a small variety of this species were found on a specimen of *Coronula diadema* taken off a whale. In the conical shape and the small, oval, entire orifice they closely resemble var. *coccopoma*. Some show a slight longitudinal ribbing on the parietes, but this is quite obsolete in others. Those growing on the radii of the *Coronula* reproduce more or less distinctly the transverse striation. It seems inadvisable to name this form at present. (S.A.M., No. 1324.)

Balanus algicola Pilsbry.

1916. *Balanus algicola*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 72, pl. xii, figs. 3, 3g, text-figs. 12, 13.

Typical forms were taken from the bottom of s.s. "Pieter Faure," 15/4/98, after cruising for some months in Cape waters. They were associated with *maxillaris*.

Further typical examples were taken on *Mytilus* shells growing between tide-marks at Hout Bay, Cape Peninsula (11/2/14. K. H. B.).

A very depressed variety with rather strong ribs was taken at East London (s.s. "Pieter Faure," 3/7/01) at low tide on *Turbo sarmaticus*. The largest examples measure 4 mm. in rostro-carinal diameter and 1-1.5 mm. in height. Colour: pale pink, the ribs white. Except in shape and external sculpture these examples differ in no respects from the typical white tubulo-conical form. They may be designated var. *costatus* n.

Transitional forms between the typical form and the variety were found on a *Patella* shell at Kalk Bay, False Bay (G. Alston). (S.A.M., Nos. A 295, A 326, A 4239, and 1343 respectively.)

Balanus maxillaris Gronov.

1763. *Balanus maxillaris*. Gronovius, Zool. Gronov. Iconogr., vol. v, pl. xix, figs. 3, 4.

1790. *Lepas cylindrica*. Gmelin, Syst. Nat., p. 3213.

1854. *Balanus capensis*. Darwin, Monogr. Balanid., p. 209, pl. ii, figs. 4a, 4b.

1905. ,, ,, Gruvel, Monogr. Cirrhip., p. 218, figs. 238, 240.

1910. ,, ,, Stebbing, Gen. Cat. S.A. Crust., p. 568.

1916. ,, *maxillaris*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 77.

Stebbing attributes the species to Darwin, who first used the name *capensis* in a strictly binomial sense. I have no means of testing the validity of Gronovius' name, and, therefore, accept Pilsbry's pronouncement on this point.

Specimens are in the collection from Table Bay and from the bottom of s.s. "Pieter Faure." (S.A.M., Nos. 1342, A 289, A 295, and A 296.)

Subgen. EUBALANUS Broch.

1916. *Balanus* (da Costa). Pilsbry, loc. cit., p. 77.

1922. *Eubalanus*. Broch, loc. cit., p. 314.

Balanus trigonus Darwin.

1854. *Balanus trigonus*. Darwin, Monogr. Balanid., p. 222, pl. iii, figs. 7, *a-f*.
1867. „ *armatus*. F. Müller, Arch. Naturgesch., vol. i, p. 329, pl. vii, figs. 1-21, 23-28; pl. viii, figs. 44, 46-48; pl. ix, fig. 56.
1897. „ *trigonus*. Weltner, *ibid.*, 1897, p. 262, B. ii, 1.
1905. „ „ Gruvel, Monogr. Cirrhip., p. 223, figs. 248, 249.
1911. „ „ Krüger, Beitr. Cirrip. Ostas, p. 49, pl. i, fig. 6; pl. iii, fig. 33, text-figs. 98-100.
1913. „ „ Hoek, Siboga Exp. Monogr., 31B, p. 158 (note on systematic position).
1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 111, pl. xxvi, figs. 1-13e, text-figs. 27, 28.
1921. „ „ Nilsson-Cantell, Zool. Bidrag. Upsala, vol. vii, p. 319, fig. 66.
1922. „ „ Weltner, Wiss. Erg. D. Tiefsee Exp., vol. xxiii, pt. 2, p. 85.

Krüger has pointed out the presence of recurved teeth on the 3rd cirrus, and thinks that these forms which now possess armed cirri, like the present species, originally lived in sponges, since the claw-like spines are admirably adapted to keep the orifice free from the invading sponge, as was also noted by Fritz Müller. Further evidence that this explanation is correct he finds in the fact that *trigonus* sometimes lives in sponges at the present day. He reports several small specimens from Japanese seas in this habitat. At the Cape also a few small specimens were found quite embedded in a sponge.

In some of the examples examined there were 1-3 tiny upturned spines on the anterior ramus of the 4th cirrus as well as the claw-like spines on both rami of the 3rd cirrus, which are always present.

Locality.—Typical specimens are found all round the South African Coast from False Bay to Zululand, low-tide to 40 fathoms, attached to stones, shells, bases of Gorgonias, *Lepralia*-like Polyzoans, bottoms of ships, bases of horny sponges. The small specimens embedded in the loose horny sponge still contained the animals and thus had not been overgrown by the sponge after death. (S.A.M., Nos. A 296, A 3905, A 3918-3921, A 4273-4281, and A 4295.)

Geogr. Distribution.—Indo-Pacific, incl. Red Sea, Japan, California, Peru, East Indies, Australia, and New Zealand, Atlantic, West Indies, Brazil, Madeira, Azores, South Africa (Darwin, Gruvel, Krüger); Gt. Fish Bay (Weltner).

Additional habitats are sea-urchin spines (Gruvel) and Decapod crabs (Krüger).

The bathymetrical range appears to be very great, as specimens have been recorded from 150 metres (Krüger), 450 metres (Nilsson-Cantell), and even 3000 metres (Gruvel).

Balanus spongicola Brown.

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| 1827. | <i>Balanus spongicola.</i> | Brown, Illustr. Conch. Gr. Brit. and Irel., pl. vii, fig. 6. |
| 1844. | „ <i>spongicola.</i> | Brown, <i>ibid.</i> , 2nd ed., pl. liii, figs. 14–16. |
| 1854. | „ „ | Darwin, Monogr. Balanid., p. 225, pl. iv, figs. 1, a–d. |
| 1905. | „ „ | Gruvel, Monogr. Cirrhip., p. 225, fig. 251. |
| 1910. | „ <i>spongicola.</i> | Stebbing, Gen. Cat. S.A. Crust., p. 568. |
| 1916. | „ <i>spongicola.</i> | Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 115, pl. xxv, figs. 2, 3, 4–4c, text-figs. 29–31. |

The colour varies from uniform red or pink, through forms with the rostrum much paler or even white, to uniform white.

The 3rd or the 4th cirri may be armed with a few short upturned spines; if on the 3rd both rami are usually armed, if on the 4th only the anterior ramus; but they may be absent altogether on either one or the other cirrus.

Specimens attached to shells, corals, or embedded in sponges are tubulo-conical; some specimens attached to the outside of a hard siliceous sponge are much depressed.

Locality.—Saldanha Bay, and numerous localities round the South African Coast from False Bay to Zululand, low tide to 90 fathoms.

Geogr. Distribution.—Great Britain, Mediterranean, Madeira, West Indies, Cape of Good Hope (Darwin); La Guayra, Caracas (Weltner); Chagos, Seychelles (Gruvel); Patros Island, off Brazil (Pilsbry).

Balanus amphitrite Darwin.

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| 1789. | ? <i>Balanus radiatus.</i> | Bruguère, Encycl. Meth., p. 168. |
| 1790. | ? <i>Lepas purpurea.</i> | Spengler, Skr. Naturh. Selsk., vol. i, p. 172. |

1795. *Lepas balanoides*. Poli, Testac. Utr. Siciliae, p. 23, pl. v, figs. 2, 7 (*non* Linnaeus).
 1815. „ *radiata*. Wood, Gener. Conch., pl. vii, fig. 7.
 1854. *Balanus amphitrite*. Darwin, Monogr. Balanid, p. 240, pl. v, figs. 2-20.
 1897. „ „ Weltner, Archiv. Naturg., p. 264.
 1905. „ „ Gruvel, Monogr. Cirrhip., p. 232.
 1907. „ *carenotus*. Gruvel, Mem. As. Soc. Beng., vol. ii, No. 1, p. 6.
 1911. „ *amphitrite*. Krüger, Beitr. Cirrip. Ostas, p. 51.
 1913. „ „ Hoek, Siboga Exp. Monogr., 31B, p. 167.
 1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, pl. lxxxix (with subspecies).

Widely distributed in tropical and subtropical seas.

The following varieties have been discovered living in South African waters.

var. communis.

1854. Darwin, *loc. cit.*, p. 240, pl. v, figs. 2e, h, l.
 1911. Krüger, *loc. cit.*, p. 57, pl. i, fig. 7 ; pl. iv, fig. 34.
 1921. Nilsson-Cantell, Zool. Bidrag. Upsala, vol. vii, p. 311, fig. 64.

Several groups on various dead Lamellibranch shells, Umhloti River, N.W. by W. $\frac{3}{4}$ W., distant 3 miles (Natal), 25 fathoms.

Several on the Rhizopod *Botellina pinnata*, Umhloti River, N.W., distant $1\frac{1}{2}$ miles, 27 fathoms.

S.S. "Pieter Faure," 12/12/00 and 21/12/00. (S.A.M., Nos. A 293 and A 4238.)

var. obscurus.

1854. Darwin, *loc. cit.*, p. 241, pl. v, fig. 2g.

Several on *Siphonaria* shells, Port Beaufort, St. Sebastian Bay (C. A. Fairbridge).

On a shell of *Terebralia palustris*, Durban Bay (H. W. Bell-Marley).

On the aerial rootlets of mangrooves, Delagoa Bay (K. H. B.), October 1912. (S.A.M., Nos. 1350, A 3917 and A 316 respectively.)

**Balanus crenatus* Brug.

1789. *Balanus crenatus*. Bruguère, Encycl. Meth. (Vers.), vol. i, p. 168.

1854. *Balanus crenatus*. Darwin, Monogr. Balanid., p. 261, pl. vi, figs. 6, *a-g*.
 1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 569.
 1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 165, pls. xxxix-xl, text-figs. 49-54 (with new subspecies).
 1921. „ „ Nilsson-Cantell, Zool. Bidrag. Upsala, vol. vii, p. 326.

Not represented in the collection.

This species has a very wide distribution in the Northern Hemisphere, and is recorded by Darwin and Gruvel from within and South of the Tropics. But Pilsbry is unwilling to accept these extensions until confirmed by further material.

Balanus poecilotheca Krüger.

1911. *Balanus poecilotheca*. Krüger, Beitr. Cirrip. Ostas, p. 48, pl. i, figs. 2, *c-e*; pl. iii, figs. 32, text-figs. 95-97.
 1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 110.

Shell tubulo-conical when attached to other specimens, or depressed conical and laterally compressed when attached to the thin stems of Gorgonians and Hydroids.

One specimen of No. 4230, attached to a stem, is 8 mm. long \times 4 mm. wide, only 4 mm. high, orifice very wide, opercular valves missing, lateral compartments keeled from apex to base near the rostral suture, rostrum concave, radii very wide, the pariete forming a narrow raised rib.

Upper lip with 1-3 teeth on either side of the notch, usually not symmetrically arranged.

Maxilla, about 6 spines between the 2 large outer ones and the 2 large inner ones, thus differing slightly from Krüger's description.

First cirrus, anterior ramus 13-jointed, basal joints protuberant and densely setose, posterior ramus 7-jointed, joints widened and densely setose.

Second cirrus, cirri not very unequal, 9- and 10-jointed, the joints broad and densely setose.

Third cirrus, rami subequal, ca. 11-jointed, distal anterior face of each joint in both rami with 2-5 short, minute conical teeth.

Fourth to sixth cirri, 20-24-jointed, each joint with 3 pairs of long setae and a shorter pair below them on the anterior margin.

Penis with a distinct basi-dorsal point.

Length.—Up to 8 mm. basal rostro-carinal diameter ; width, 5 mm. ; length of orifice, 5 mm. ; *height*, 6 mm.

Colour.—Pale pink, variously streaked and speckled with darker pink or crimson, the radii and rostrum occasionally pure white ; or the whole shell is white with the carina very faintly tinted pink.

Locality.—Numerous specimens from several localities from Cape Morgan to Durnford Point (Zululand), 25–85 fathoms. S.S. “Pieter Faure.” (S.A.M., Nos. A 4229–A 4237.)

Geogr. Distribution.—Japan (Krüger) ; Sulu Archipelago, 24–161 fathoms (Pilsbry).

I am indebted to Dr. Pilsbry for his opinion on this species which belongs to a “group of very critical species.” Dr. Pilsbry corrected my first belief that this was Hoek’s *B. amphitrite*, var. *malayensis*, by pointing out the difference in the armature of the cirri.

Subgen. *HESPERIBALANUS* Pilsbry.

1916. *Hesperibalanus*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 192.

Balanus elizabethae n. sp.

Shell low-conical, covered with a very thin almost colourless epidermis. Orifice pentagonal, only slightly notched.

Base unknown, but probably thin, as the rather fragile shell has not been injured in any way by removal from the object on which it was growing.

Parietes externally smooth, not porous, internally with regular, strong ribs extending up to the sheath, and crenulate at the base. Sheath very short, horizontally ribbed.

Radii broad, summits at 45° with base, the edges denticulate.

Alae broad, summits only slightly oblique.

Scutum thin, externally concave, with faint growth-lines about as far apart as in *hesperius laevidomus* Pilsbry ; basal margin considerably longer than tergal margin, articular ridge very prominent, adductor ridge faint, pit for depressor muscle obsolete.

Tergum rather thick, basal margin strongly concave between the prominent depressor-muscle crests and the spur, which is rather more than $\frac{1}{4}$ basal width, subtruncate, distinct from basi-scutal angle, articular ridge prominent and overhanging the deep articular groove, external surface without groove or impressed lines, apex blunt and corroded, growth-lines fine and closer together than on scutum.

Labrum with 2 teeth on either side of notch. Palps as in *hesperius* Pilsbry.

Mandible, 1st-3rd teeth acute, less widely separated than in *hesperius nipponensis*, 4th and 5th rudimentary, obtuse, but distinctly removed from the subacute inner angle, lower edge setose.

Maxilla, inner edge straight, with 9 spines below the 2nd and the outer angle, which are very slightly larger than the rest.

First cirrus, anterior ramus 20-jointed, the lower 10 joints rather larger than the distal ones and slightly protuberant anteriorly, posterior ramus only $\frac{1}{2}$ length of anterior, 10-jointed, very stout, half as broad as long, tapering distally, all the joints except the last 2 very broad and protuberant anteriorly.

Second cirrus, rami subequal, ca. 12-jointed, stout, all the joints broader than long and anteriorly protuberant, densely setose.

Third cirrus, rami subequal, anterior ca. 15-, posterior ca. 12-jointed, joints 2-7 of anterior ramus with a number of minute granules or tubercles on their anterior margins, posterior margins of joints 1 to about 9 very minutely spinulose, posterior ramus with the usual setae only, basal joint of anterior ramus swollen.

Fourth cirrus, rami subequal, 25-30-jointed, unarmed with spines, anterior margins of joints with 4 pairs of setae.

Fifth and sixth cirri, rami subequal, ca. 35-jointed, posterior margins of all the joints of both rami very minutely spinulose as in 3rd cirrus, anterior margin of each joint with 4 pairs of setae and a minute 5th pair below.

Penis longer than posterior cirri, sparsely setose.

Length.—Basal rostro-carinal diameter, 10 mm.; orifice, 5 mm.; height, 4 mm.

Colour.—White, translucent when wet.

Locality.—Zwartkops River (tidal), Port Elizabeth, 3 specimens (Mrs. T. V. Paterson, 1913). (S.A.M., No. 2255.)

This form is evidently closely allied to *hesperius* Pilsbry, 1916, especially to the Japanese form *nipponense*. The characters of *nipponense* appear to have been further developed, as instance the shape of the opercular-valves. The 1st cirrus, however, is very characteristic of the new species.

Subgen. *CHIRONA* Gray.

1835. *Chirona*. Gray, Phil. Tr. Roy. Soc., 1835, pt. 1, p. 37.

1913. *Striatobalanus*. Hoek, Siboga Exp. Monogr., 316, p. 159.

1916. *Chirona*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 203.

Balanus tenuis Hk.

1883. *Balanus tenuis*. Hoek, Challeng. Rep., vol. viii, p. 154,
pl. 13, figs. 29–33.
1905. „ „ Gruvel, Monogr. Cirrhip., p. 247, fig. 275.
1913. „ „ Hoek, Siboga Exp. Monogr., 31B, p. 190,
pl. 17, figs. 14–19; pl. 18, fig. 1.
1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 216.

The largest specimen measures 18 mm. in rostro-carinal diameter and 7 mm. in height. It is attached to a dead shell of *Neptuneopsis gilchristi* Sow. Other smaller specimens with the same proportions attached to *Cassia achatina*.

Another specimen, attached to *Oniscia macandrewi*, is more tubulo-conical, being 10 mm. in height and 9 mm. in rostro-carinal diameter.

They agree with Hoek's description. The tergum has the scutal margin either straight or slightly concave. Contrary to Gruvel's statement I find there is a very distinct basi-dorsal point on the penis in the one specimen which contains the animal.

Colour.—Creamy-white.

Locality.—Nanquas Peak, N. by E. $\frac{1}{4}$ E., distant 10 miles, 59 fathoms, 2 specimens; Cape Natal, W. by N., distant 4 miles, 47 fathoms, 1 specimen; Cape Natal, N. $\frac{1}{2}$ W., distant, 4 miles, 55 fathoms, several specimens. S.S. "Pieter Faure," 3/12/01, 14/12/00, and 24/12/00. (S.A.M., Nos. A 309, A 4271, and A 4272.)

Geogr. Distribution.—Philippine Islands, 100–115 fathoms and 275 metres (Hoek); Philippine Islands and China Sea, 102–244 fathoms (Pilsbry).

Subgen. MEMBRANOBALANUS Hk.

1913. *Membranobalanus*. Hoek, Siboga Exp. Monogr., 31B,
pp. 159–205.
1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93,
p. 229.

Balanus orcutti Pilsbry.

1907. *Balanus orcutti*. Pilsbry, Proc. Ac. Nat. Sci. Philad., p. 361,
pl. xxix, figs. 1–7.
1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93,
p. 233, pl. lv, figs. 2–2d.

Agrees well with Pilsbry's description. The walls show irregular growth-lines which are seen most distinctly on the rostrum. The

rostrum is twice as long as the other compartments, with no trace of a longitudinal groove and not tapering so strongly as in *longirostrum* Hoek, 1913, interior with several irregularly arranged, longitudinal, more or less parallel grooves. Lateral compartments twice as wide as carino-laterals. Carina only a little longer than the carino-laterals and laterals. Sheath horizontally ridged, with a brown setose membrane.

Scutum and tergum as described by Pilsbry, also covered with brown setose membrane.

Labrum with a rather wide and not very deep notch, 2 teeth on either side and a setulose margin. Palp elongate, apically upturned, upper margin concave (as in *longirostrum* Hk.).

Mandible similar to that of *longirostrum*, 1st, 2nd, and 3rd teeth well developed, 4th rudimentary, 5th obsolete, inferior angle subacute, distance between 1st and 2nd greater than that between 2nd and 3rd.

Maxilla, inner margin straight, about 8 spines between the outer and inner pairs.

Outer maxilla as in *longirostrum*.

First cirrus with stout, very unequal rami, the anterior 25-jointed, the posterior 8-jointed, with the joints protuberant on the anterior faces.

Second cirrus with slightly unequal rami, 12- and 13-jointed, joints not very protuberant.

Third cirrus with slightly unequal rami, 16- and 18-jointed, without stout spines.

Fourth cirrus with slightly unequal rami, 20- and 32-jointed, joints 1-12 of the anterior ramus with 3-5 short, stout upwardly directed spines on anterior apices, joints 3-12 in addition with 2-4 stout, recurved spines, anterior apices of 1st and 2nd joints of pedicel with a row of stout, upwardly directed spines, those on first joint smaller and more numerous.

Pedicels of 4th-6th cirri very long. Rami of 5th and 6th cirri subequal, ca. 32-35-jointed, without stout spines.

Penis very long, 15 mm., transversely rugulose, with scattered setae and minutely bifid apex.

Length of rostrum of largest specimen, 13 mm.; of carina, 8 mm.; rostro-carinal basal diameter, ca. 13 mm.

Colour.—White, the membrane covering the sheath, terga, and scuta deep yellowish-brown.

Locality.—Algoa Bay, 26 fathoms, 4 specimens in a horny sponge. S.S. "Pieter Faure," 6/12/98. (S.A.M., No. A 3922.)

Geogr. Distribution.—California (Pilsbry).

Darwin's *declivis* is found in the West Indies and Hoek's *longirostrum* in the Malay Archipelago. All three species are closely allied.

In the original description an evident *lapsus calami* occurs by which both in the text and in the explanation to plate "carina" and "rostrum" are transposed. This is corrected in the 1916 description.

Subgen. CONOPEA Say.

1822. *Conopea*. Say, Journ. Ac. Nat. Sci. Philad., vol. ii, p. 323.

1854. *Balanus* (sect. B.). Darwin, Monogr. Balanid., p. 216.

1913. *Patellabalanus*. Hoek, Siboga Exp. Monogr., 31B, pp. 160–221.

1916. *Conopea*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 234.

1922. „ Broch, Vidensk. Medd. Naturh. For., vol. lxxiii, p. 325.

Balanus scandens Pilsbry.

1916. *Balanus scandens*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. lvi, pl. 56, figs. 2–2d, text-fig. 76.

1921. „ „ Nilsson-Cantell, Zool. Bidrag. Upsala, vol. vii, p. 334.

Shell elongate in the rostro-carinal axis, sitting obliquely on the Gorgonian stem and attached only by the lower central part of the base. Whole shell completely covered by the coenenchyma and polyps of the Gorgonian. Epidermis thin, golden-brown.

Base compressed conical, no basal furrow, solid, internally smooth except around the periphery where short ribs are developed corresponding with those on the walls. An angle between the walls and the base. The upper edge of the basal cup and the lower edge of the walls do not meet closely, but leave a narrow space between, which is cut up into a series of little square pores by the internal ribs which are continuous from the walls to the base. This space is, of course, covered by the epidermis externally.

Parietes not porous, externally smooth, internally ribbed at the base; sheath very long, slightly ribbed horizontally. Carina and rostrum strongly elongate, not touching the stem. The internal cavity does not extend along the prolongations, which are thus solid. Carino-laterals about $\frac{1}{5}$ width of laterals. Radii well developed, horizontally striated, not deeply sunk, summits parallel with base.

Alae with summits horizontal or slightly oblique. Sutural edges distinctly crenated.

Scutum high and narrow, outer surface only with growth-lines which are strongly marked and form strong teeth on the occludent margin, articular ridge prominent, obliquely truncate below, adductor ridge obsolete, pit for depressor muscles shallow, a series of faint interrupted, short, longitudinal ridges near the apex, basal margin not strongly convex, basi-tergal angle not much rounded off.

Tergum with scutal margin slightly concave, carinal margin convex, apex acute, shortly projecting, apical angle less than a right angle, growth-lines well marked, no longitudinal striae, a spur fasciole, but no groove or impressed lines, articular ridge not prominent, crests for depressor muscles distinct, a series of interrupted ridges near the apex as in the scutum, spur very short, half basal width, entirely confluent with the basi-acutal angle, which is rounded, and sloping into the basal margin on the carinal side.

Labrum with 3 very minute teeth on each side. Palps as in *scandens* Pilsbry.

Mandible with 5 distinct teeth, 4th and 5th small, 2nd, 3rd, and 4th bifid, the secondary edge on the 4th being crenulate, inner angle squarely truncate.

Maxilla, inner edge straight, 5 spines between the 2 outer and 2 inner enlarged ones.

First cirrus, rami unequal, anterior 10-jointed, posterior 6-jointed, 4 joints of which are protuberant.

Second cirrus, rami unequal, anterior 10-jointed, posterior 8-jointed, all the joints (except the apical ones) protuberant.

Third cirrus, rami unequal, anterior 12-jointed, posterior 10-jointed, anterior ramus with a few short upturned spines on the protuberant anterior margins of the joints.

Fourth cirrus, rami subequal, ca. 20-jointed, unarmed with spines, joints with 3 pairs of setae.

Fifth and sixth cirri, rami subequal, ca. 22-jointed, unarmed with spines, joints with 3 pairs of setae and a minute 4th pair of setules below.

Penis 3 times length of posterior cirri, transversely rugulose, sparsely setose, with a well-marked basi-dorsal point.

After having drawn up the above description based on a single individual and decided to make it a new species, further specimens were discovered bearing the same number and growing on the same Gorgonian as the first specimen. An animal from one of these differed in no respect from the above description except in lacking the basi-

dorsal point on the penis. Thus it agrees almost down to the minutest details with Pilsbry's description of *scandens*.

On the characters of the opercular valves also these latter specimens cannot be distinguished from the one first described nor from *scandens*. But in the shape of the shell this specimen approaches Hoek's figure of *investitus*, except that the rostrum is raised farther from the supporting stem.

Even had one regarded the greatly elongate form as an older stage than the moderately elongate form, one would not have ventured to assign them to *scandens*. By a fortunate chance, however, on the same stem next to one of the specimens resembling *investitus* there sits a specimen which is exactly like Pilsbry's figure of *scandens*. Moreover, this specimen contained the animal, which on examination proved to differ in no respect from the above description; the basidorsal point on the penis is present.

Excluding this last character and the presence of the faint interrupted ridges on the interior of the scuta and terga, neither of which seem to me to be really important, we see there is no reason against assigning all these specimens to Pilsbry's species.

Pilsbry had only 1 specimen from which to draw up this diagnosis, the actual size of which we are not told. But it was not very large. I regard it as a juvenile. The Cape specimen in the same stage measures in rostro-carinal diameter 5 mm., total height, 5 mm. The next stage is represented by the form resembling *investitus*, the corresponding measurements being 7 mm. and 5.5 mm. After this the rostrum and carina and those portions of the base opposed to them begin to elongate. The elongations, as noted above, do not include extensions of the central cavity, they are quite solid. This stage, represented by the single specimen described above, measures as follows: rostro-carinal length, 17 mm.; orifice, 3 mm.; height of shell, 5 mm.; of shell plus base, 8 mm.

Colour.—Pale pinkish, radii white, epidermis golden-brown.

Locality.—O'Neil Peak, N.N.W. $\frac{1}{4}$ W., distant 8 miles (Zululand), 55 fathoms. S.S. "Pieter Faure," 28/2/01, 1 adult, 3 half-grown, 1 juv., on *Villogorgia mauritiensis*, associated with *B. poecilotheca* Krüger. The coenenchyma and the polyps completely cover up the shell, and the axis of the Gorgonian appears to swell out around the point of attachment of the base, thus tending to make the attachment all the more secure. (S.A.M., No. A 4228.)

Geogr. Distribution.—Japan, 65–125 fathoms (Pilsbry and Nilsson-Cantell).

Gen. *ACASTA* Leach.

- 1817. *Acasta*. Leach, Journ. de Physique, vol. lxxxv.
- 1854. „ (subgen.). Darwin, Monogr. Balanidae, p. 302.
- 1905. „ Gruvel, Monogr. Cirrhip., p. 258.
- 1906. „ Annandale in Herdman's Ceylon Pearl Fish. Suppl.
Rep., xxxi, p. 145.
- 1911. „ Krüger, Beitr. Cirrip. Ostas, p. 56.
- 1912. „ Pilsbry, Proc. U.S. Nat. Mus., vol. xlii, p. 294.
- 1913. „ Hoek, Siboga Exp. Monogr., 31B, p. 232.
- 1916. „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 241.
- 1921. „ Nilsson-Cantell, Zool. Bidrag. Upsala, vol. vii, p. 341.
- 1922. „ Broch, Vidensk. Medd. Naturh. For., vol. lxxiii,
p. 330.

Darwin made this a subgenus of *Balanus* because he found it impossible to fix on any character by which the *Acasta*-forms could be separated from the *Balanus*-forms, even the habitat not being conclusive.

Darwin knew of one *Acasta* species, *purpurata*, which did not live in sponges. Since then Annandale has described a species, *funiculorum*, which is attached openly to the surface of a coral.

If any further fact were needed to break down all distinctions between *Balanus* and *Acasta*, it is furnished by the species described below which has a membranous base, thus agreeing with the species of *Membranobalanus*.

But since Darwin's time authors have considered *Acasta* as of generic rank, mainly for the sake of convenience and on account of the unmistakable *facies* which all the species possess.

Key to the South African species.

I. Base calcareous.

A. Tergum without a proper groove from apex to spur.

1. No gaps at the bases of the parietes.

a. Base cup-shaped (nearly always). Radii not as wide as parietes.

i. Outer surface with short rigid projections. Base often porous *spongites* (Poli).

ii. Outer surface with long flexible projections
sulcata Darw., var. *anchoris* n.

b. Base more or less flattened. Radii wider than parietes
cyathus Darw.

2. Small gaps at the base of the parietes *alba* n. sp.

B. Tergum with a distinct and well-marked groove.

1. No gaps at bases of parietes. Base flat. Tergum not cancellate
fossata n. sp.
2. Small gaps at bases of parietes (at least in the adult). Base cup-shaped. Tergum cancellate . . . *pectinipes* Pilsbry.

II. Base membranous, sometimes feebly calcified round the edges in the adult
membranacea n. sp.*Acasta spongites* (Poli).

1791. *Lepas spongites*. Poli, Testac. Utriusque Siciliae, vol. i, p. 25, pl. vi, figs. 3-6.
1854. *Acasta* ,, Darwin, *loc. cit.*, p. 308, pl. ix, figs. 1, a-d.
1905. ,, ,, Gruvel, *loc. cit.*, p. 263, fig. 293.
1910. ,, ,, Stebbing, Gen. Cat. S.A. Crust., p. 570.
1911. ,, ,, subsp. *japonica*. Pilsbry, Bull. Bur. Fish., vol. xxix (1909), p. 80, pl. xvi, figs. 1-9.
1916. ,, ,, and *japonica*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, pp. 242, 243, text-figs. 77, 78.

- a. Carino-lateral parietes about $\frac{1}{3}$ width of lateral parietes . . . *forma typica*.
- b. Carino-lateral parietes $\frac{1}{2}$ width of lateral parietes . . . subsp. *japonica*.

There are four lots. The specimens in the first lot have 4 rows of pores, 1 from centre to each carino-lateral pariete and 1 to each of the sutures between the rostrum and the lateral parietes. The row to the carino-lateral pariete is really double and sometimes the two rows are distinct, making 6 rows of pores in all.

In the second lot there are some specimens with the base nearly wholly porous, others in which the lower part is porous and the upper part solid, either with or without 4 or 6 rows of pores as described above. The base also is sometimes nearly flat (*cf.* figure of *scuticosta* Weltner), in others very deep, even deeper than the height of the shell, 15 mm., 9 mm.

The third lot have rather shallow, non-porous bases.

The fourth lot closely resembles the subsp. *japonica*. It has, however, the partly, or almost wholly perforated base characteristic of the typical Cape form. Base often very deep and curled to one side. Fourth cirrus with anterior margins of all the joints of *both* rami and both margins of the 2nd joint of the pedicel scabrous with minute spinules, as described by Darwin, but apparently more numerous. Only 3 pairs of setae on the joints of the 6th cirrus.

The first 3 lots were all in an open horny sponge, but the 4th lot were embedded in a soft slimy species of sponge.

Pilsbry, in 1916, has separated the Japanese form specifically. In view of the porous base of the Cape specimens, which link them on to the typical form, I prefer to regard it as a subspecies.

Colour.—White, yellowish, or pinkish.

Locality.—33° 6' S., 28° 11' E. (off East London), 85 fathoms; Umhloti River, N. by W. $\frac{1}{2}$ W., distant 8 miles (Natal), 40 fathoms; Durnford Point, N.W. $\frac{3}{4}$ W., distant 12 miles (Zululand), 90 fathoms; Umkomaas River, N.W. by W. $\frac{1}{2}$ W., distant 5 miles (Natal), 40 fathoms. S.S. "Pieter Faure," 28/1/99, 18/12/00, 28/2/01, and 3/12/00. (S.A.M., Nos. A 4112–15.)

Geogr. Distribution.—North Atlantic, Mediterranean, Cape of Good Hope (Darwin); Red Sea, Persian Gulf (Gruvel); Japan, 103 fathoms (Pilsbry) (subsp. *japonica*).

Acasta sulcata, var. *anchoris* n.

(Plate I, fig. 16.)

1818.	<i>Acasta sulcata</i> .	Lamarck, Anim. Sans. Vertébr.
1831.	" "	Deshayes in Guérin. Mag. de Zool., pl. xxiv.
1854.	" "	Darwin, <i>loc. cit.</i> , p. 310, pl. ix, figs. 2, <i>a-d</i> .
1897.	" "	Weltner, Arch. f. Naturgesch., 1897, Bd. i.
1905.	" "	Gruvel, <i>loc. cit.</i> , p. 263, fig. 294.
1911.	" "	Krüger, <i>loc. cit.</i> , p. 56, pl. i, fig. 9; pl. iv, fig. 40.

Darwin recognised 2 varieties, but without giving them names. The present form is so distinct that I think it deserves a name.

Subglobular. Walls slightly converging. Orifice not very large, deeply notched.

Base variable, irregularly cup-shaped, depth variable, oval, with the centre always to one side, usually nearest the carinal edge, but in one case nearer the animal's right side, in one specimen very deep and so strongly curved that the centre points in the same direction as the orifice. Lines of growth distinct, especially on the outer side where the growth is greatest; edge crenulate, no internal teeth.

Walls externally smooth, with (typically) rather long, calcified but flexible filamentous projections; these vary much in development, being sometimes short or even absent altogether except for 2–3 short ones on the carina.

Parietes internally ribbed, apices incurved. Carino-lateral pariete

narrow, $\frac{1}{8}$ as wide as lateral pariete, reaching to base, ala and radius both reaching to base, both a little wider than the pariete, with very oblique summits. No slits at base.

Scutum, basal margin not greatly longer than tergal margin, articular ridge well developed, not terminating abruptly below, adductor ridge and cavities for depressor muscles feeble, surface with growth-ridges only, the longitudinal striae obsolete.

Tergum slightly beaked, scutal margin slightly concave, about equal to basal margin, spur short, about $\frac{1}{3}$ basal width, articular ridge feeble, depressor crests obsolete, surface with growth-ridges only, a very slight, broad, longitudinal depression increasing in width towards the spur.

Labrum with 3 denticles on inner apex, palps obliquely truncate.

Mandible, 3rd tooth double, 4th and 5th rudimentary, inner angle with 2 minute denticles and setose on inner margin.

Maxilla, inner edge quite straight, with 9-10 subequal spines, the outer and inner ones not larger than the others.

First cirrus, rami very unequal, 7- and 19-jointed.

Second cirrus, rami slightly unequal, 8- and 10-jointed.

Third cirrus, rami subequal, 9-jointed, unarmed.

Fourth cirrus, rami equal, 10- and 11-jointed, 2nd joint of peduncle with 9 stout recurved teeth on anterior margin, anterior ramus with 2 recurved teeth on joints 1 and 2, 2-4 on joints 3 and 4, and 1-2 on joint 5.

Fifth and sixth cirri, rami 15-18-jointed, with no trace of recurved teeth or spines, 3 pairs of setae on anterior margin and apical pair on posterior margin.

Penis longer than posterior cirri, setulose, strongly rugulose, apex subacute.

Length of shell, 3 mm.

Colour.—White.

Locality.—Tugela River, N.W. by W., distant 3 miles (Natal), 14 fathoms, 6 specimens. S.S. "Pieter Faure," 16/1/01. (S.A.M., No. A 4209.)

Geogr. Distribution.—West Australia (Lamarck); South Australia and N.S. Wales (Darwin); Philippines (Weltner); Japan, 15-22 metres (Krüger).

Acasta cyathus Darwin.

1854. *Acasta cyathus*. Darwin, *loc. cit.*, p. 312, pl. ix, figs. 3, *a-c*.

1905. „ „ Gruvel, *loc. cit.*, p. 259, fig. 287.

Tergum resembling that of *fenestrata*, but not "furrowed in the line of the spur," with growth-ridges only, spur $\frac{1}{2}$ width of basal margin, distinct from basi-scutal angle, articular ridge not prominent, depressor crests obsolete.

Labrum, palps obliquely truncate, outer apical angles subacute.

Mandible, 2nd, 3rd, and 4th teeth double, 5th small, but distinct; inner angle bifid more distinctly so on the one side than on the other.

Maxilla, inner edge quite straight, 6-7 spines following the 2 outer ones and increasing in size to the 2 inner ones which are nearly equal to the 2 outer ones.

First cirrus, posterior ramus 16-jointed, twice as long as 6-jointed anterior ramus.

Second cirrus, posterior 11-jointed, ramus slightly longer than 8-jointed anterior ramus.

Third cirrus, rami subequal, 13-jointed, unarmed.

Fourth cirrus, rami subequal, 17-jointed, 2nd joint of peduncle with 2 recurved teeth and 2 minute denticles on anterior apical angle, anterior ramus with 2-3 unequal recurved teeth on joints 1-7, 1 tooth on joint 8.

Fifth and sixth cirri unarmed, each joint with 3 pairs of setae on anterior margin.

Penis longer than posterior cirri, setulose, and rugulose.

Length of shell, 4 mm.; of basal cup, 1.5 mm.; greatest diameter, 4 mm.

Colour.—Uniform white in spirit.

Locality.—33° 9' S., 28° 3' E. (off East London), 47 fathoms, 1 specimen; 33° 6' S., 28° 11' E. (off East London), 85 fathoms, 1 specimen; Scottburgh, N.W. by N., distant 8 miles (Natal), 92 fathoms, 1 specimen. S.S. "Pieter Faure," 28/12/98, 28/1/99, and 7/3/01. (S.A.M., Nos. A 4216-8.)

Acasta fossata n. sp.

More or less conical, slightly narrowing above, widest at base. Orifice large, not very deeply notched. Walls externally with growth-lines and numerous small, short points. Radii as wide as or a little narrower than their parietes, summits not very oblique, with faint horizontal and oblique striae. No gaps. Parietes internally strongly ribbed, the lateral margins thickened and projecting inwards. Sheath horizontally ribbed. Carino-lateral pariete $\frac{1}{2}$ width of lateral pariete.

Base saucer-shaped, very shallow or quite flat, oval more or less

distinctly hexagonal, thick, externally with growth-lines, internally with 6 more or less distinct, never prominent, radiating ridges, each thickened into a tooth at the periphery, but not bifid.

Scutum thick, high, and narrow, basal margin much the shortest, slightly convex, outer surface with growth-ridges densely covered with a short thick pile, articular ridge prominent, oblique below, adductor ridge prominent, pits for adductor and depressor muscles distinct.

Tergum short, not so thick as scutum, carinal margin shortest, a wide and deep groove running to spur, which is nearly equal to, sometimes quite equal to, half basal width, rounded below, basiscutal angle usually distinct but sometimes confluent with spur, surface with growth-ridges covered with a short dense pile, articular ridge not very distinct, depressor crests distinct, in fact nearly the whole of the inner surface has a number of small irregular, often interrupted, ridges.

Mandible, 2nd and 3rd teeth obscurely double, 4th distinct, 5th scarcely distinct from blunt inner angle.

Maxilla, inner edge with a shallow notch, with 3-4 small spinules in it, followed by 8 spines of which 2 near the inner angle are as large as the 2 on outer angle.

First cirrus, posterior 16-jointed ramus twice as long as 8-jointed anterior ramus, the joints of which are lobed posteriorly.

Second cirrus, anterior 10-jointed ramus slightly longer than 8-jointed posterior ramus.

Third cirrus, rami subequal, 14-jointed, 5-6 little upturned spines on both rami, but stronger on the anterior.

Fourth cirrus longer, but with similar armature.

Fifth cirrus, joints of the anterior ramus with 2-3 spinules, rather indistinct.

Sixth cirrus unarmed. Joints of 5th and 6th cirri with 3 pairs of setae on anterior margin and 1 pair on posterior apex.

Penis longer than posterior cirri, setulose, rugulose.

Length of walls, 8 mm.; greatest basal diameter, 8 mm.

Colour.—White in spirit.

Locality.—33° 53' S., 25° 51' E. (Algoa Bay), 26 fathoms, 4 specimens; Seal Island, S.S.W., distant $\frac{1}{2}$ mile (False Bay), 12 fathoms, 1 specimen; 33° 50' S., 25° 54' E. (Algoa Bay), 1 specimen. S.S. "Pieter Faure," 6/12/98, 24/8/03, and 11/11/98. (S.A.M., Nos. A 4213-5.)

One specimen (No. A 4215) is more elongate, the walls measuring 11 mm., and the greatest width is above the base, the base measuring

only 5 mm. Except for this difference, there is nothing to separate this specimen from the others.

Acasta pectinipes Pilsbry.

1912. *Acasta pectinipes*. Pilsbry, Proc. U.S. Nat. Mus., vol. xlii, p. 294.
 1913. „ *nitida*. Hoek, Siboga Exp. Monogr., 31B, p. 237, pl. xxiv, figs. 17-19; pl. xxv, figs. 1-3.
 1916. „ *pectinipes*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 247.

For purposes of comparison I give the following description of the Cape specimens.

Base cup-shaped, with faint lines of growth, upper edge minutely crenulate, no internal teeth. In young specimens of 3-4 mm. capitular height, the base is quadrangular, very slightly convex, scarcely 1 mm. in depth, with a minute central point and 4 shallow grooves radiating to the corners. In a specimen of 6 mm. capitular height, the base is regularly cup-shaped, conical, 4 mm. deep, and oval at the top. In the largest specimen of 8 mm. capitular height, the base is also 8 mm. deep, oval at the top, regularly conical for the lower $\frac{3}{4}$, and then cylindrical as far as the walls, which slightly overlap the edge of the base. This series was taken out of the same sponge and shows the changes in shape undergone during growth. The smallest and the largest might quite easily have been considered specifically distinct had they occurred separately.

All the parietes incurved at the top. Orifice not very large, nor deeply notched.

Parietes internally grooved, corresponding with external ridges, but not also horizontally ribbed as in *nitida*. External ridges denticulate.

Carino-lateral pariete very narrow, forming a narrow rib reaching to base, where it is about $\frac{1}{7}$ (or less) the width of the lateral pariete, ala not broader than pariete, but radius widening until it is a little broader, neither ala nor radius extending more than half-way down pariete, leaving a narrow membrane-covered slit between the parietes. Similar slits are left between the rostrum and the lateral parietes. In young specimens they are so slight as to escape notice, and certainly would have been overlooked had not the young specimens been in the same series with adult specimens.

Scutum with short tergal margin, nearly straight, occludent margin toothed, longitudinal ribs and growth-ridges moderately strong,

equally developed, producing a cancellate appearance, in the largest specimens the later growth-ridges predominate, so that the cancellate appearance is seen only on the apical half, even here it is never as strongly marked as in the tergum; articular ridge strong, articular furrow deep, cavity for depressor muscles shallow.

Tergum broad, roughly equilateral, the 3 margins being about equal, carinal margin convex, scutal margin slightly concave, spur short and broad, but not more than $\frac{1}{3}$ width of valve, its distal margin truncated parallel with basal margin. Externally the longitudinal furrow begins only in the lower half, whence it widens rapidly to the whole width of the spur. Carinal portion of valve strongly cancellate, but in the largest specimens, as in the scutum, this is only seen at the apical half, farther down the growth-ridges predominate. Scutal portion with growth-ridges only. Articular ridge distinct, articular furrow deep, depressor crests very faint.

Anatomy of a medium-sized specimen (capitulum height, 6 mm.).

Mandible, 2nd and 3rd teeth double, 4th and 5th small, inner angle blunt, non-spinose.

Maxilla, inner edge straight, 7 spines between outer and inner large pairs.

First cirrus, rami very unequal, 7- and 19-jointed.

Second cirrus, rami slightly unequal, 8- and 10-jointed.

Third cirrus, rami equal, 12- and 13-jointed, unarmed.

Fourth cirrus, rami equal, 24- and 30-jointed, 2nd joint of peduncle with 12 recurved teeth, first 10 joints of anterior ramus with recurved teeth, 2 and 1 on 9th and 10th joints respectively, posterior ramus unarmed.

Fifth cirrus, rami equal, ca. 35-jointed, unarmed.

Sixth cirrus, rami equal, ca. 40 jointed. Each joint of 5th and 6th cirri with 3 pairs of setae on anterior margin.

Penis 12 mm. long, tapering to an acute apex, rugulose, setulose.

Length.—Up to 16 mm.; greatest diameter, up to 10 mm.

Colour.—Pinkish or salmon, the colour deepest at the apices of the parietes.

Locality.—Cape Morgan, N.N.W., distant 7 miles, 52 fathoms, 1 specimen; False Bay, 17 fathoms, 4 specimens (juv. and adult); Umkomaas River, N.W. by W. $\frac{1}{2}$ W., distant 5 miles (Natal), 40 fathoms, 2 specimens; 33° 6' S., 28° 11' E. (off East London), 85 fathoms, 1 specimen. S.S. "Pieter Faure," 12/8/01, 8/10/02, 31/12/00, and 28/1/99. (S.A.M., Nos. A 311, A 3924, A 4219, and A 4221.)

Geogr. Distribution.—Philippine Islands, 18 fathoms (Pilsbry:

pectinipes); 6° 15' S., 110° 50' E. (Java Sea), 40–50 metres (Hoek : *nitida*).

The number of external "prickly threads" varies, increasing with age. The strength of the "prickles" also varies, some being smooth points, others being almost tuberculate and strongly scabrous.

Pilsbry did not describe the animal of his specimens, if it was present. It will be noticed that there are slight differences between my account and Hoek's description of the anatomy of *nitida*, the chief being the absence of recurved teeth on the 5th cirrus in the Cape specimens. This, however, is not important enough to overrule the many other points of agreement. Similarly the presence of the horizontal ribs on the interior of the parietes is not a feature of great consequence; and the absence of the slits between the parietes may well be due to Hoek's specimens not having been adult. I had already come to the conclusion that Hoek's *nitida* was synonymous with Pilsbry's *pectinipes*, before receiving Pilsbry's 1916 paper, in which I find an authoritative confirmation of my views.

The cancellate tergum and the external sculpturing are the most characteristic features of this species.

Acasta membranacea n. sp.

Conical, walls slightly converging. Orifice large, deeply notched. Base nearly or quite flat, thin, membranous, completely so in all the small and some of the larger specimens, partially calcified in other large specimens round the periphery where the depressor muscles of the opercular valves are attached, in one case feebly calcified all over.

Parietes thin, not porous, externally with growth-lines and numerous irregular short calcareous projections, leaving where broken off pore-like scars; internally smooth, lateral margins more or less strongly ribbed, sheath with slight horizontal ridges. Carino-lateral pariete $\frac{1}{4}$ (or less) width of lateral pariete. Carina longer than rostrum. Radii not wider than their parietes, summits very oblique.

Scutum higher than wide, with moderately strong growth-ridges, longitudinal striae sometimes distinct, sometimes quite obsolete, articular ridge strong, oblique below, adductor ridge and cavities for adductor and depressor muscles well-marked, occludent margin somewhat inflexed forming at the basal angle a small elongate pit.

Tergum strongly beaked, the beak sometimes moderately stout, sometimes very narrow and elongate, falcate, scutal margin thus concave, basal margin shortest, surface with growth-ridges only, a

moderately deep and narrow groove from apex to the spur, which is $\frac{1}{3}$ as long and $\frac{1}{4}$ as wide as basal margin, moderately narrow, obliquely truncate, basi-scutal angle distinct, acute; width of groove and consequently of the spur is a little variable.

Mandible, 2nd tooth double, 4th small, 5th not distinct from blunt inner angle.

Maxilla, inner margin straight or with a very small notch, 8-10 spines between the 2 outer large spines and the 2 inner large ones.

First cirrus, posterior 18-jointed ramus twice as long as anterior 8-jointed ramus, the joints of the latter broader than long, almost moniliform, strongly setose.

Second cirrus, rami subequal, 10-12-jointed.

Third cirrus, rami subequal, 15-18-jointed, anterior ramus with 3-4 small upturned spines on all the joints except the distal 2 or 3.

Fourth cirrus, rami 25-27-jointed, both rami with 4-6 small upturned spines on all the joints except the distal ones, posterior margin also of 1st joint (which is longer than the others) of anterior ramus with a row of small upturned spines.

Fifth and sixth cirrus, rami 30-32-jointed, posterior margin of 1st joint spinose as in 4th cirrus. Each joint with 3 pairs of setae on anterior margin and 1 pair on posterior apex.

Penis long, rugulose, setulose, apex subacute.

Length of carina, up to 14 mm.; greatest basal width, up to 10 mm.

Colour.—In spirit, white.

Locality.—Durnford Point, N.W. $\frac{3}{4}$ W., distant 12 miles (Zululand), 90 fathoms, 1 specimen; Umhloti River, N. by W. $\frac{1}{2}$ W., distant 8 miles (Natal), 40 fathoms, 2 specimens; 33° 6' S., 28° 11' E. (off East London), 85 fathoms, several specimens; Umkomaas River, N.W. by W. $\frac{1}{2}$ W., distant 5 miles (Natal), 40 fathoms, several specimens; Tugela River, N.W. by W., distant 3 miles (Natal), 14 fathoms, 1 specimen; Cone Point, N.W. $\frac{1}{2}$ W., distant 4 miles (Zululand), 34 fathoms, several specimens; Umtwalumi River, N. by W., distant 7 miles (Natal), 50 fathoms, 4 specimens. S.S. "Pieter Faure," 28/2/01, 18/12/00, 28/1/99, 31/12/00, 16/1/01, 27/2/01, and 11/3/01. (S.A.M., Nos. A 3923, A 4212, A 4222-7.)

In *Pachastrella isorrhopa* Krkp. and other *Hexactinellid* sponges. This species differs from *scuticosta* Weltner, in having a membranous base, which, however, is variable, as shown above. The groove on the tergal spur is not mentioned in Gruvel's description of this species (I have not seen the original description), nor are the appendages

described. There is a possibility of running the two species together when a larger series is forthcoming.

Gen. TETRACLITA Schumacher.

1817. *Tetracrita*. Schumacher, Essai d'un nouveau système des Habitations des Vers Testacés, p. 91.
 1817. *Conia*. Leach, Journ. Phys., vol. lxxxv, p. 69.
 1822. *Polytrema*. Ferussac, Dict. class. d'Hist. Nat., vol. ii, p. 144.
 1854. *Tetracrita*. Darwin, Monogr. Balanid., p. 321.
 1905. „ Gruvel, Monogr. Cirrhip., p. 284.
 1913. „ Hoek, Siboga Exp. Monogr., 31B, p. 253.
 1916. „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 248.

Key to the South African species.

1. Parietes with several rows of pores.
 - a. Surface, smooth or ribbed. Scutum with articular and adductor ridges parallel not joining *squamosa* (Brug.).
 - b. Surface with serrated ribs. Scutum with articular and adductor ridges joining and forming a cavity which runs up to the apex . . . *serrata* Darw.
2. Parietes with a single row of pores . . . subgen. *Tesseropora rosea* (Krss.).

**Tetracrita squamosa* (Brug.).

1789. *Balanus squamosus*. Bruguière, Encycl. Meth. (Vers), vol. i, p. 170, pl. clxv, figs. 9, 10.
 1790. *Lepas porosa*. Gmelin, Syst. Nat., ed. 13, vol. i, pt. 6, p. 3212.
 1854. *Tetracrita porosa*. Darwin, *loc. cit.*, p. 329, pl. x, figs. 1, a-m.
 1897. „ „ Weltner, Arch. Naturg., vol. lxiii, pt. 1, p. 257.
 1905. „ „ Gruvel, *loc. cit.*, p. 287, figs. 308 B, 312.
 1911. „ „ Krüger, Beitr. Cirrip. Ostas, p. 60, pl. iv, figs. 41b, c.
 1913. „ „ Hoek, *loc. cit.*, p. 254.
 1916. „ *squamosa*. Pilsbry, *loc. cit.*, p. 249 (with new subspecies).

Widely distributed in tropical and subtropical regions. Not represented in the collection.

Tetrachlita serrata Darwin.

1854. *Tetrachlita serrata*. Darwin, Monogr. Balanid., p. 234, pl. x, figs. 2, *a-d*.
 1897. „ „ Weltner, Arch. Naturg., vol. lxiii, pt. 1, p. 258.
 1905. „ „ Gruvel, Monogr. Cirrhip., p. 289, fig. 313.
 1906. „ „ Annandale in Herdman's Ceylon Pearl Fish. Suppl. Rep., 31, p. 144.
 1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 571.
 1911. „ „ Krüger, Beitr. Cirrip. Ostas, p. 61, pl. iv, fig. 41a.
 1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 249.

According to Weltner and Krüger, a series of transitional forms can be found between *squamosa* and this species (see Krüger, pl. iv, figs. 41b, 2-7), showing that *serrata* should be regarded only as a variety of *squamosa*.

Specimens in the collection from Table Bay and False Bay (R. M. Lightfoot and K. H. B.); Cove Rock, near East London (s.s. "Pieter Faure"); Durban (K. H. B.). (S.A.M., Nos. A 298, A 306, and A 320.)

There are also 3 large specimens, 30 mm. basal diameter, in the "Pieter Faure" collection bearing the reference number 2250 (S.A.M., No. A 297). The corresponding locality in the log-book is "Lion's Head, N. 67° E., distant 25 miles (off Cape Peninsula), 131 fathoms." From the depth given I think one may legitimately conclude that the number "2250" is either a mistake or has been placed in the wrong bottle, as the members of this genus are found only in the littoral zone.

Other localities are Algoa Bay (Darwin) and Pondoland (Weltner), Ceylon (Annandale).

Subgen. TESSEROPORA Pilsbry.

1916. *Tesseropora*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 259.
 1921. *Tessepora* [*sic*]. Nilsson-Cantell, Zoolog. Bidrag. Upsala, vol. vii, p. 365.

**Tetrachlita rosea* (Krss.).

1848. *Conia rosea*. Krauss, Die Südafrik. Moll., p. 136, pl. vi, fig. 28.
 1854. *Tetrachlita rosea*. Darwin, Monogr. Balanid., p. 335, pl. x, figs. 3, *a-d*.

1905. *Tetrachlita rosea*. Gruvel, Monogr. Cirrhip., p. 286, fig. 310.
 1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 571.
 1916. „ „ Pilsbry, *loc. cit.*, p. 760, pl. lviii, fig. 4.

Not represented in the collection by South African specimens.

Geogr. Distribution.—Australia.

Subfam. CHELONIBIINAE.

1916. *Chelonibiinae*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 262.

Gen. CHELONIBIA Leach.

1817. *Chelonibia*. Leach, Journ. Phys., vol. lxxxv, p. 68.
 1818. *Coronula* (part). Lamarek, Anim. sans Vertebr., vol. v, p. 385.
 1854. *Chelonobia*. Darwin, Monogr. Balanid., p. 382.
 1905. „ Gruvel, Monogr. Cirrhip., p. 266.
 1916. *Chelonibia*. Pilsbry, *loc. cit.*, p. 262.

Key to the South African species.

1. Raddi well-developed, though narrow, usually notched. Cavities between the basal septa rather deep *testudinaria* Linn.
2. Raddi not developed, or very narrow. Cavities filled up almost to the base, septa much interrupted. Shell very thick and heavy . . . *caretta*. (Spengl.).

Chelonibia testudinaria (Linn.).

1758. *Lepas testudinaria*. Linnaeus, Syst. Nat., ed. 10, p. 668.
 1825. *Astrolepas rotundarius*. Gray, Ann. Philos. (N.S.), vol. x, p. 105.
 1854. *Chelonobia testudinaria*. Darwin, *loc. cit.*, p. 392, pl. xiv, figs. 1, *a-d*, 5; pl. xv, fig. 1.
 1905. „ „ Gruvel, Monogr. Cirrhip., p. 267, fig. 297, A.
 1906. „ „ Annandale in Herdman's Ceylon Pearl Fish. Suppl. Rep., 31, p. 143.
 1911. „ „ Krüger, Beitr. Cirrip. Ostas, p. 57, text-figs. 121–125.
 1916. „ „ Pilsbry, *loc. cit.*, p. 264, pl. lxii, figs. 1–4.

Widely distributed in all tropical and warm temperate seas on the loggerhead turtle.

Specimens are in the collection from Table Bay, without date or donor. (S.A.M., No. 1340.)

Chelonibia caretta (Spengl.).

1790. *Lepas caretta*. Spengler, Skr. Natur. Selsk., vol. i, p. 185, pl. vi, fig. 4.
 1854. *Chelonobia caretta*. Darwin, Monogr. Balanid., p. 394, pl. xiv, fig. 2.
 1905. „ „ Gruvel, Monogr. Cirrhip., p. 269, fig. 297, D.
 1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 267, pl. lxiii, figs. 5, 5a.

Two specimens, 30 mm. in diameter, on a Green Turtle (*Chelone midas*) caught in Table Bay, 1919. (S.A.M., No. A 4314.)

Specimens from Cape of Good Hope are in the Paris Museum (*teste* Pilsbry). Not mentioned by Gruvel.

Geogr. Distribution.—West Africa, N. Australia (Darwin); Venezuela, Massana, Torres Straits (Weltner); Saigon (Paris Museum, *teste* Pilsbry); West Indies, New Jersey, East Indies, Brazil (Pilsbry). Usually on loggerhead turtles.

Subfam. CORONULINAE.

1854. *Balaninae* (2nd sect.). Darwin, Monogr. Balanid., p. 397.
 1907. *Coronulinae*+*Xenobalaninae*. Gruvel, Monogr. Cirrhip., pp. 8, 270, 280.
 1916. *Coronulinae*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 268.

There are other genera of this subfamily, not represented in South Africa, which are found on turtles, manatees, snakes, and fishes.

Key to the South African genera.

1. Body contained within the walls. Opercular valves present.
 - a. Parietes externally ribbed. Radii broad *Coronula*.
 - b. Tubular, annulate, without longitudinal ribs. Radii narrow *Tubicinella*.
2. Body elongate, resembling a naked Pedunculate barnacle, not contained within the walls, which are minute. Opercular valves absent . . . *Xenobalanus*.

Gen. CORONULA Lam.

1802. *Coronula*. Lamarck, Ann. Mus., vol. i, p. 464.
 1854. „ Darwin, Monogr. Balanid., p. 397.
 1916. „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 271.

Key to the South African species.

1. Orifice much larger than basal opening. Branches of the sutural ribs asymmetrical or absent. Terga wanting or very minute.
 - a. Crown-shaped. Parietes convex, with convex rugose ribs . *diadema* (Linn.).
 - b. Depressed. Parietes with flat, beaded ribs . . . *reginae* (Darw.).
2. Orifice not larger than basal opening. Branches of the sutural ribs symmetrical. Terga present *complanata* (Mörch).

Coronula diadema (Linn.).

1767. *Lepas diadema*. Linnaeus, Syst. Nat., ed. 12, p. 1108.
 1776. „ *balaenaris*. O. F. Müller, Zool. Dan. Prodr., p. 250.
 1854. *Coronula diadema*. Darwin, Monogr. Balanid., p. 417, pl. xv, figs. 3, 3b; pl. xvi, figs. 1, 2, 7.
 1897. „ „ Weltner, Arch. Naturg., vol. lxiii, pt. 1, p. 254.
 1900. „ „ Weltner, Fauna Arctica, vol. i, p. 302.
 1900. „ „ Marloth, Tr. Philos. Soc. S. Afr., vol. xi, pt. 1, p. 1.
 1903. „ „ Stead, Proc. Linn. Soc. N.S.W., vol. xxviii, p. 944.
 1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 571.
 1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 273, pl. lxv, figs. 3-4.

Widely distributed over the Northern and Southern hemisphere. On the Humpback Whale (*Megaptera*).

Stead's record, quoted by Pilsbry, is open to doubt, as he says the whale "appeared to be a Finback (*Balaenoptera*). There are specimens in the South African Museum labelled as from *Balaena australis*. (S.A.M., Nos. 1323-5, A 229, A 305.)

Coronula reginae Darwin.

1854. *Coronula reginae*. Darwin, Monogr. Balanid., p. 419, pl. xv, fig. 5; pl. xvi, fig. 4.
 1916. „ „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 275, pl. lxiv.

Stebbing in the Gen. Cat. S.A. Crust., p. 572, regards *reginae* as doubtfully distinct from *diadema*. Darwin believed that *reginae* replaced *diadema* in the Pacific.

Distribution.—Northern and Southern Atlantic, Pacific.

On *Megaptera*.

There are 5 specimens in the South African Museum from Table Bay. One of these bears a very strong outward resemblance to a *diadema* of the same size. (S.A.M., No. A 4300.)

Coronula complanata (Mörch).

1790. *Lepas balaenaris*. Spengler, Str. Naturh. Selsk., vol. i, p. 187
(*non* O. F. Müller).
1818. *Cetopirus* ,, Ranzani, Opusc. Scient., vol. ii, p. 87.
1848. *Coronula* ,, Krauss, Die Südafrik. Moll., p. 135.
1852. *Cetopirus complanatus*. Mörch, Catalog. Conchyl. Comes de
Cjoldi, p. 67.
1854. *Coronula balaenaris*. Darwin, Monogr. Balanid., p. 415,
pl. xv, figs. 2–2*b*; pl. xvi, figs. 3, 5.
1910. ,, *darwinii*. Stebbing, Gen. Cat. S.A. Crust., p. 572.
1916. ,, *complanata*. Pilsbry, Bull. U.S. Nat. Mus., No. 93,
p. 276, pl. lxiii, figs. 1, 2, 3, 3*a*.

Four specimens in the collection from Table Bay and Simonstown.
(S.A.M., No. 1326.)

Distribution.—East Indies; New South Wales, West Africa; West coast South America; Norway (see Pilsbry).

Gen. TUBICINELLA Lam.

1802. *Tubicinella*. Lamarck, Ann. Mus., vol. i, p. 461.
1854. ,, Darwin, Monogr. Balanid., p. 430.

Tubicinella striata Lam.

1802. *Tubicinella (major), (minor), striata*. Lamarck, *loc. cit.*, p. 463,
pl. xxx, fig. 1.
1806. *Lepas trachealis*. Shaw, Shaw and Nodder's Naturalist's Mis-
cellany, vol. xvii, pl. dccxxvi.
1848. *Tubicinella balaenarum*. Krauss, Die Südafrik. Moll., p. 135.
1854. ,, *trachealis*. Darwin, *loc. cit.*, p. 431, pl. xvii,
figs. 3, *a–c*.
1900. ,, ,, Marloth, Tr. Phil. Soc. S. Afr., vol. ii,
pt. 1, p. 1.
1903. ,, ,, Gruvel, Deutsch Südpol. Exp.,
vol. ii, p. 216.

1910. *Tubicinella striata*. Stebbing, Gen. Cat. S.A. Crust., p. 573.

1916. „ *major*. Pilsbry, Bull. U.S. Nat. Mus., No. 93,
p. 281, pl. lxxv, fig. 5.

Specimens in the collection from the Southern Right Whale (*Balaena australis*) taken in Table Bay and False Bay. (S.A.M., Nos. 1327, A 300, A 304.)

Distribution.—Southern Atlantic Ocean.

Gen. XENOBALANUS Stnstrp.

1851. *Xenobalanus*. Steenstrup, Vedensk. Medd. Naturh. For.
Kobenhaven, pl. iii, figs. 11–15.

1852. „ Steenstrup, Overs. K. dansk. Vidensk. Selsk.
Forhl. Telt., 1852, pp. 158, 161.

1852. *Siphonicella*. Darwin, Monogr. Lepadidae, p. 156.

1854. *Xenobalanus*. Darwin, Monogr. Balanidae, p. 438.

1905. „ Gruvel, Monogr. Cirrhip., p. 280.

1916. „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 282.

Xenobalanus globicipitis Stnstrp.

1851. *Xenobalanus globicipitis*. Steenstrup, *loc. cit.*, pl. iii, figs.
11–15.

1852. „ „ Darwin, *loc. cit.*, p. 440, pl. xvii,
figs. 4, a–c.

1905. „ „ Gruvel, *loc. cit.*, p. 281, figs.
304, 305.

1916. „ „ Pilsbry, *loc. cit.*, p. 283, pl. lxxv,
figs. 2–2b, and var. *pallidus*,
p. 284, pl. lxxv, fig. 1.

1920. „ „ Calman, Ann. Mag. Nat. Hist. (9),
vi, p. 165.

1923. „ „ *natalensis*. Stebbing, Fish. Mar. Surv. S. Afr.,
Spec. Rep., 3, p. 12, pl. xvi.

The reasons given for the institution of the species *natalensis* are, in my opinion, quite inadequate. Even the “rough sketch” (explanation to pl. xvi) of the shell belies Stebbing’s statement that it is only 5-rayed.

I have examined 4 specimens received from Mr. Bell-Marley from the tail of *Tursiops catalaniae*, caught in Natal, 1919 (S.A.M., No. A 4317), evidently part of the same catch from which Stebbing received his specimens. All four specimens have a typical 6-rayed

shell. The penis is large, as described by Stebbing, but the character of only 4 teeth in the mandible is not a constant one; it is probable that Stebbing overlooked the 5th tooth, which is minute.

Further, I have seen a large number of perfectly typical specimens from the tail-flukes of a blue whale caught off Saldanha Bay (S.A.M., No. A 4320, collected by Mr. J. Drury, 1922).

This remarkable barnacle bears an extremely close resemblance to a stalked barnacle, especially to *Conchoderma auritum*; but is always attached directly to the skin of its host, whereas *Conchoderma* is always attached to another sessile barnacle.

Distribution.—Northern Atlantic, on the Black Fish (*Globicephalus*), Finner Whale (*Balaenoptera physalis*); Antarctic (on Finner Whale).

Fam. CHTHAMALIDAE.

1854. *Chthamalinae* (subfam.). Darwin, Monogr. Balanid., p. 446.

1916. *Chthamalidae*. Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 290.

Key to the South African genera.

- | | |
|------------------------------|--------------------|
| 1. Compartments, 6 | <i>Chthmalus</i> . |
| 2. Compartments, 8 | <i>Octomeris</i> . |

Gen. CHTHAMALUS Ranz.

1817. *Chthamalus*. Ranzani, Opusc. Scient., vol. i, p. 276.

1818. „ Ranzani, *ibid.*, vol. ii, p. 83.

1837. *Euraphia*. Conrad, Journ. Ac. Nat. Sci. Philad., vol. vii, p. 261.

1854. *Chthamalus*. Darwin, Monogr. Balanid., p. 447.

1916. „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 293.

1921. „ Nilsson-Cantell, Zool. Bidrag. Upsala, vol. vii, p. 274.

Chthamalus dentatus Krss.

1848. *Chthamalus dentatus*. Krauss, Die Südafrik. Moll., p. 135, pl. vi, fig. 27.

1854. „ „ Darwin, *loc. cit.*, p. 463, pl. xviii, figs. 3, a-c.

1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 574.

1921. „ „ Nilsson-Cantell, *loc. cit.*, p. 282, fig. 52.

Pilsbry in his Monograph has given on pp. 295, 296 a grouping of the species based primarily on the mandible. He has added a footnote

stating that as he has not dissected *C. dentatus* (and others) it may have been placed in the wrong group. As a matter of fact it is wrongly placed. It should be grouped under 1a, having a mandible like that figured for *C. stellatus*, fig. 8, A D, in Pilsbry's work. Darwin's description of the inferior part as being "coarsely pectinated" is certainly misleading. (See also Nilsson-Cantell, 1921, p. 275.)

Specimens from Table Bay, False Bay, and Durban (K. H. B.). (S.A.M., Nos. 1346, 1451, A 302, and A 3904.)

Geogr. Distribution.—West Africa, Loanda, Gold Coast, Madagascar, Gulf of Aden. Littoral and attached to ships' bottoms.

Gen. OCTOMERIS Sowerby.

1825. *Octomeris*. Sowerby, Zool. Journ., vol. ii, p. 244.
 1854. „ Darwin, Monogr. Balanid., p. 482.
 1916. „ Pilsbry, Bull. U.S. Nat. Mus., No. 93, p. 334.
 1921. „ Nilsson-Cantell, Zool. Bidrag. Upsala, vol. vii, p. 298.

Octomeris angulosa Sow.

1825. *Octomeris angulosa*. Sowerby, *loc. cit.*, p. 244, pl. xii, figs. 1-11.
 1854. „ „ Darwin, *loc. cit.*, p. 483, pl. xx, fig. 2a, b.
 1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 575.
 1916. „ „ Pilsbry, *loc. cit.*, p. 334.

Young specimens from a sheltered position at Smitswinkel Bay (False Bay) show very strong longitudinal ribs on the parietes, and the uncorroded opercular valves have prominent growth-ridges. Basal margin of scutum straight.

Specimens from Table Bay, False Bay (K. H. B.), Port Elizabeth (Mrs. T. V. Paterson), and Durban (K. H. B.). (S.A.M., Nos. 1344, 1345, A 308, A 315, A 319, and A 328.)

Geogr. Distribution.—There is a typical specimen in the collection labelled as from "Australia." (S.A.M., No. 1331.)

ASCOTHORACICA.

1905. *Ascothoracica*. Gruvel, Monogr. Cirrhip., p. 336.

Fam. DENDROGASTERIDAE.

1905. *Dendrogasteridae*. Gruvel, *loc. cit.*, p. 345.

Gen. DENDROGASTER Knip.

1890. *Dendrogaster*. Knipovitch, Biol. Centralb., vol. x, p. 707.

**Dendrogaster arborescens* le Roi.

1905. *Dendrogaster arborescens*. le Roi, Zool. Anz., vol. xxix, p. 399.

1907. „ „ le Roi, Zeitsch. Wiss. Zool., vol. cxxxvi, p. 100.

In the *Asteroid*, *Dipsacaster sladeni* ("Valdivia" Exp.).

Dr. H. L. Clark of the Museum of Comparative Zoology, who has reported on the "Pieter Faure" collection of Echinoderms (Ann. S. Afr. Mus., vol. xiii, pt. 7, 1923), and who, at my request, kept a special look-out for parasitic Cirripedes, tells me that he found no specimens either of this or any other form.

ACROTHORACICA.

1905. *Acrothoracica*. Gruvel, Monogr. Cirrhip., p. 310.

1909. „ „ Calman in Lankester's Treatise, p. 140.

1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 575.

Fam. KOCHLORINIDAE.

1909. *Kochlorinidae*. Calman, loc. cit., p. 140.

Gen. KOCHLORINE Noll.

1872. *Kochlorine*. Noll, Ber. Senckenb. Ges., 1871-2, p. 24.

1897. „ „ Weltner, Arch. Naturg., vol. lxiii, pt. 1, p. 237.

**Kochlorine bihamata* Noll.

1883. *Kochlorine bihamata*. Noll, Zool. Anz., vol. vi, No. 147, p. 471.

1883. „ „ Hoek, Challeng. Rep., vol. viii, p. 6.

1905. „ „ Gruvel, Monogr. Cirrhip., p. 334.

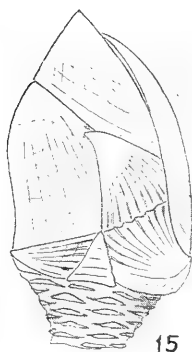
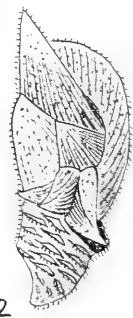
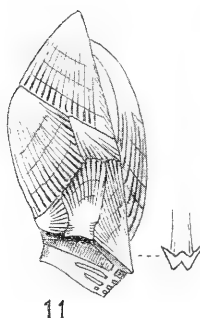
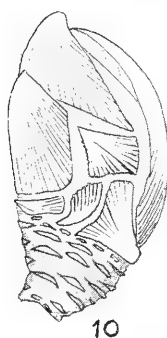
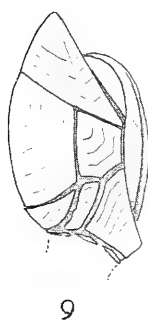
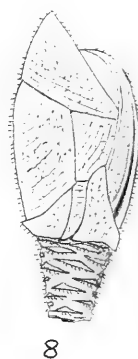
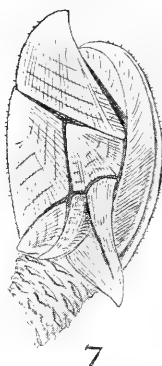
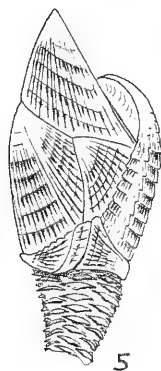
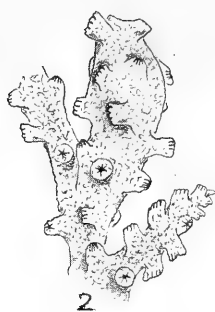
1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 575.

In cavities in the shell of *Haliotis*, Cape of Good Hope (Noll).

EXPLANATION OF PLATE.

FIG.

1. *Smiliium hypocrites* n. sp. ♂ × 5, cleaned.
2. *Smiliium hypocrites* n. sp. ♀ × 4, in its natural position on a branch of *Villogorgia mauritiensis*, concealed by the coenosarc and polyps of the latter.
3. *Scalpellum ornatum* (Gray), aberration. ♀ × 5.
4. *Scalpellum faurei* n. sp. ♀ × 6.
5. *Scalpellum cancellatum* n. sp. ♀ × 5.
6. *Scalpellum subalatum* n. sp. ♀ × 6.
7. *Scalpellum capense* n. sp. ♀ × 7.
8. *Scalpellum agulhense* n. sp. ♀ × 6.
9. *Scalpellum porcellanum* n. sp. ♀ × 8.
10. *Scalpellum brachium-cancris* Welt. ♀ × 3.
11. *Scalpellum brevicaulis* n. sp. ♀ × 10. With dorsal view of carinal latus.
12. *Scalpellum eumitos* n. sp. ♀ × 3.
13. *Scalpellum uncinatum* n. sp. ♀ × 5.
14. *Scalpellum natalense* n. sp. ♀ × 10.
15. *Scalpellum bottellinae* n. sp. ♀ × 9. The dotted line indicates the size of the male.
16. *Acasta sulcata* Darwin, var. *anchors* n. sp. × 8.



K.H.B. del.

INDEX.

A	PAGE		PAGE
<i>Abisia</i>	48	<i>Chirona</i>	73
<i>Acasta</i>	79	CHTHAMALIDAE	97
ACROTHORACICA	99	<i>Chthamalinae</i>	97
<i>agulhense</i> (Scalpellum)	28	<i>Chthamalus</i>	97
<i>alba</i> (<i>Acasta</i>)	83	<i>communis</i> (<i>Balanus</i> <i>amphitrite</i>	
ALEPADIDAE	62	<i>var.</i>)	70
<i>Alepadinae</i>	62	<i>communis</i> (<i>Balanus</i> <i>tintinnabulum</i>	
<i>Alepas</i>	62	<i>var.</i>)	66
<i>aligicola</i> (<i>Balanus</i>)	67	<i>complanata</i> (<i>Coronula</i>)	95
<i>amphitrite</i> (<i>Balanus</i>)	69	<i>Conchoderma</i>	61
<i>Anaspidae</i>	62	<i>Conchotrya</i>	48
<i>Anatifa</i>	50	<i>Conia</i>	90
<i>anatifera</i> (<i>Lepas</i>)	50	<i>Conopea</i>	76
<i>anchoris</i> (<i>Acasta</i> <i>sulcata</i> <i>var.</i>)	81	<i>cor</i> (<i>Octolasmis</i>)	58
<i>angulosa</i> (<i>Octomeris</i>)	98	<i>Coronula</i>	93
<i>anserifera</i> (<i>Lepas</i>)	50	<i>Coronulinae</i>	93
<i>arborescens</i> (<i>Dendrogaster</i>)	99	<i>coutieri</i> (<i>Octolasmis</i>)	58
<i>armata</i> (<i>Balanus</i>)	68	<i>crassa</i> (<i>Poecilasma</i>)	52
ASCOTHORACICA	98	<i>crenatus</i> (<i>Balanus</i>)	70
<i>Astrolepas</i>	92	<i>cyathus</i> (<i>Acasta</i>)	82
<i>aurantia</i> (<i>Poecilasma</i>)	51	<i>cylindrica</i> (<i>Balanus</i>)	67
<i>auritum</i> (<i>Conchoderma</i>)	61		
<i>australis</i> (<i>Lepas</i>)	50		
		D	
B		<i>darwinii</i> (<i>Coronula</i>)	95
<i>balaenaris</i> (<i>Coronula</i>)	94	<i>darwinii</i> (<i>Scalpellum</i>)	17
BALANIDAE	64	<i>Dendrogaster</i>	99
<i>Balaninae</i>	64	DENDROGASTERIDAE	98
<i>balanoides</i> (<i>Balanus</i>)	70	<i>dentatus</i> (<i>Chthamalus</i>)	97
<i>Balanus</i>	64	<i>diadema</i> (<i>Coronula</i>)	94
<i>bellum</i> (<i>Megalasma</i>)	55	<i>Dichelaspis</i>	56
<i>bihamata</i> (<i>Kochlorine</i>)	99	<i>dubia</i> (<i>Poecilasma</i>)	51
<i>botellinae</i> (<i>Scalpellum</i>)	44		
<i>brachium-cancr</i> (<i>Scalpellum</i>)	29	E	
<i>breve</i> (<i>Poecilasma</i> <i>inaequilaterale</i>		<i>elizabethae</i> (<i>Balanus</i>)	72
<i>subsp.</i>)	53	<i>equina</i> (<i>Octolasmis</i>)	59
<i>brevicaulis</i> (<i>Scalpellum</i>)	32	<i>Eubalanus</i>	67
<i>Brismaeus</i>	48	<i>eumitos</i> (<i>Scalpellum</i>)	34
		<i>Euraphia</i>	97
C		<i>Euscalpellum</i>	11
<i>Calantica</i>	10		
<i>calceolus</i> (<i>Balanus</i>)	65	F	
<i>cancellatum</i> (<i>Scalpellum</i>)	24	<i>fascicularis</i> (<i>Lepas</i>)	50
<i>capense</i> (<i>Scalpellum</i>)	26	<i>faurei</i> (<i>Scalpellum</i>)	22
<i>capensis</i> (<i>Balanus</i>)	67	<i>fossata</i> (<i>Acasta</i>)	84
<i>carenotus</i> (<i>Balanus</i>)	70		
<i>caretta</i> (<i>Chelonibia</i>)	93	G	
<i>carinatum</i> (<i>Megalasma</i>)	54	<i>globicipitis</i> (<i>Xenobalanus</i>)	96
<i>Chelonibia</i>	92	<i>Glyptelasma</i>	54
<i>Chelonibiinae</i>	92		

H	PAGE	P	PAGE
Hesperibalanus	72	palinuri (Heteralepas)	62
Heteralepas	62	Paralepas	62
hilli (Lepas)	50	Parodolepas	56
hypocrites (Smilium)	14	Patellabalanus	76
I		pectinata (Lepas)	50
imperfectum (Scalpellum)	47	pectinipes (Acasta)	86
inaequilaterale (Poecilasma)	51, 53	PEDUNCULATA	10
J		Pentaspidae	49
japonica (Acasta spongites subsp.)	80	Poecilasma	50
K		poecilotheca (Balanus)	71
kaempferi (Poecilasma)	51	Pollicipedidae	10
Kochlorine	99	pollicipedoides (Smilium)	12
KOCHLORINIDAE	99	Polyaspidae	10
L		porcellanum (Scalpellum)	31
LEPADIDAE	49	porosa (Tetraclita)	90
Lepadinae	49	Protoscalpellum	11
Lepas	50	purpurea (Balanus)	69
lineatum (Megalasma)	55	R	
Litholepas	48	radiatus (Balanus)	69
Lithotrya	48	reginae (Coronula)	94
litum (Poecilasma kaempferi var.)	51	rosea (Tetraclita)	91
M		rotundarius (Chelonibia)	92
maindroni (Octolasmis)	58	rutilum (Scalpellum)	17
major (Tubicinella)	95	S	
maxillaris (Balanus)	67	SCALPELLIDAE	10
Megabalanus	65	Scalpellinae	10
Megalasma	54	Scalpellum	16
membranacea (Acasta)	88	scandens (Balanus)	76
Membranobalanus	74	serrata (Tetraclita)	91
micrum (Scalpellum)	46	SESSILIA	63
minus (Megalasma)	55	sinuatum (Scalpellum)	40
N		Siphonicella	96
natalense (Scalpellum)	39	Smilium	11
natalensis (Xenobalanus)	96	spongicola (Balanus)	69
neptuni (Octolasmis)	60	spongites (Acasta)	80
nitida (Acasta)	86	squamosa (Tetraclita)	90
O		striata (Tubicinella)	95
obscurus (Balanus amphitrite var.)	70	Striatobalanus	73
occlusa (Octolasmis)	57	striatum (Megalasma)	55
Octolasmis	56	sublatum (Scalpellum)	25
Octomeris	98	sulcata (Acasta)	81
oreutti (Balanus)	74	T	
ornatum (Scalpellum)	20	Temnaspis	50
		tenuis (Balanus)	74
		Tesseropora	91
		testudinaria (Chelonibia)	92
		testudinata (Lepas)	50
		Tetraclita	90
		tintinnabulum (Balanus)	65
		Thaliella	20
		THORACICA	10
		trachealis (Tubicinella)	95
		Trichelaspis	56
		tridens (Octolasmis)	57

	PAGE		PAGE
trigonus (Balanus) . . .	68	W	
<i>Trilasmis</i>	50	warwicki (Octolasmis) . . .	58
Tubicinella	95	weberi (Octolasmis) . . .	60
U			
uncinatum (Scalpellum) . . .	38	X	
V		<i>Xenobalaninae</i>	93
valentiana (Lithotrya) . . .	48	Xenobalanus	96
valvulifer (Scalpellum) . . .	17		
VERRUCIDAE	1, 64	Z	
virgatum (Conchoderma) . . .	61	zebra (Balanus tintinnabulum var.)	66

ANNALS

OF THE

SOUTH AFRICAN MUSEUM

VOLUME XX.

PART II, containing:—

- 2.—*The Fresh-water Entomostraca of the Cape Province*
(*Union of South Africa*). By G. O. SARS. Part II:
Ostracoda. (Plates II–XX.)



ISSUED AUGUST 1924. PRICE 12s. 6d.

PRINTED FOR THE
TRUSTEES OF THE SOUTH AFRICAN MUSEUM

BY NEILL AND CO., LTD.,
212 CAUSEWAYSIDE, EDINBURGH.

2. *The Fresh-water Entomostraca of the Cape Province (Union of South Africa).*—By G. O. SARS. Part II: Ostracoda.

(With Plates II–XX.)

INTRODUCTION.

THE present paper is the second of a series of treatises which I have intended to publish about the fresh-water Entomostraca of the southernmost part of Africa occupied by the Cape Province.* (The first part of this series has been published in vol. xv, pt. 4, of these Annals, 1916, and was wholly devoted to the *Cladocera*.) In the present part another very different group of Crustacea, viz. the *Ostracoda*,† will be dealt with.

The fresh-water Ostracoda of the African continent have been formerly studied by several distinguished zoologists: Baird, Brady, Vávra, G. W. Müller, and Daday; but the species recorded by those authors have been for the most part derived from regions outside the limits of the Cape Province, chiefly from the equatorial parts of the continent. I have, however, myself published two papers relating to the Ostracod Fauna of that region. One of these papers, issued in 1895, contains descriptions and figures of several Entomostraca, among them also some Ostracoda, all of them raised from dried mud taken from a swamp at Knysna. In the other paper, published in 1898, only a single Ostracod (*Megalocypris princeps*), derived from the neighbourhood of Cape Town, is dealt with; this Ostracod being distinguished by its truly gigantic size, as compared with the other known forms of this order.

The additional material received has partly been specified in the first part of the present account, and consists both of parcels of dried mud and of alcoholic samples. From all the parcels of mud, Ostracoda have been reared, often in great numbers, and most of the alcoholic samples also contained, in addition to Cladocera and Copepoda, a larger or smaller number of Ostracoda.

The number of species thereby observed is rather great, amounting

* One species from the Transvaal is also included.—[Ed.]

† The change of this name to *Ostrapoda*, as proposed by the Rev. T. R. R. Stebbing; cannot, I think, be sanctioned.

to no less than seventy-three in all. Most of them have been successfully reared in my aquaria, and I have thereby been enabled to examine the specimens in the fresh and living state, to ascertain the characteristic colours, and to watch their growth and behaviour during several successive generations.

As a rule, at the close of each season the bottom-residue of my aquaria has been carefully kept in a dried condition until the next season, when it again has been placed in suitably prepared aquaria, and the Ostracoda have never failed to reappear, often in great abundance, developing from the resting ova deposited in the mud during the previous season. My investigations have thus been continued during the course of several successive years, and renewed observations of the species made, to verify and complete those at first instituted.

The great tenacity of life exhibited by the resting ova is very remarkable. In the year 1909 I received from the late Dr. Purcell a considerable lot of dried mud taken by him from an old brick-pond near his residence at Bergvliet, Cape Peninsula. Of this mud some quantity is still left in its original dried condition, and I have also during the present season employed a part of it for preparing some small aquaria. In all of them some Ostracoda (of the genus *Cypridopsis*) have made their appearance, being accordingly developed from ova, which have remained dry during a period of no less than twelve years. It is my purpose to keep the rest of the mud for further experiments during the coming seasons.

The species described in the present paper are referable to two distinct families, viz. the *Cypridae* and the *Cytheridae*. Of the latter family, however, only two species have as yet come under my notice; all the other species belong to the extensive family *Cypridae*. For the discrimination of the several genera comprised within this family, the most reliable characters are to be derived from the structure of the shell, and more particularly from the mutual relation of the two valves. The several appendages exhibit on the whole a very uniform structure throughout this family; but some characters of apparently generic value may also be found, especially as regards the shape of the maxillary palp and the caudal rami.

As to the plates accompanying the present paper, I have been anxious to make the chief figures (animal seen laterally and dorsally) as perfect as possible. It will be found that several recent students of this group content themselves by giving only rough outline-figures of the shell; but such figures, I believe, must be regarded as quite

insufficient. For the ready recognition of the species more carefully executed figures, if possible drawn from fresh and still living specimens, would be highly desirable.

FAM. CYPRIDAE.

Remarks.—I am well aware that the name *Cyprididae*, employed by several authors, is grammatically a more correct derivation of *Cypris* than is *Cypridae*. The latter name is, however, in reality that proposed at the earliest date, viz. in 1850 by Baird, and it has also been retained by some of the more distinguished recent authors, for instance, by G. W. Müller and G. Alm. There are, moreover, some practical reasons which seem to make it more desirable to retain the originally proposed name. For if this name is changed in the above-mentioned manner, of course the names of the several subfamilies proposed by recent authors ought also to be changed according to the same law. But such a change would render most of these names inconveniently polysyllabic, and would, moreover, lead to severe confusion with the very different group of Ostracoda, for which the genus *Cypridina* M. Dow is the type.

As still some dissent seems to exist about the number and exact limitation of these subfamilies, I have found it right in the present paper to abstain from any subdivision of the family, and I will only here note, that two of the genera treated of in the following pages, viz. *Cypria* and *Ilyocypris*, have usually been removed each to separate subfamilies.

GEN. I. EUCYPRIS, Vávra, 1891.

Remarks.—This genus is here taken in a more restricted sense than done by Vávra and most other authors. As the type of the genus may be considered *Cypris virens* of Jurine, with which several other species agree very closely, both as to the shell and the structure of the several appendages. The genus is readily distinguished from *Cypris* (proper), the type of which is *C. pubera* O. F. Müller, by the nearly equal valves and their want of any marginal armature. All the known species of this genus seem to be exclusively parthenogenetical, no male specimens having been ever observed in any of them. Seven species of this genus will be described in the following pages.

1. EUCYPRIS TRICHOTA (G. W. Müller).

(Plate II, figs. 1-11.)

Cypris trichota, G. W. Müller. Deutsche Südpolar Expedition, Die Ostracoden, vol. x, p. 152, figs. 1-5 (in text).

Specific Characters.—Shell moderately tumid; seen laterally, rounded oval or somewhat trigonal in outline, greatest height a little in front of the middle and about equalling $\frac{3}{5}$ of the length; dorsal margin boldly arched and forming just behind the ocular region a conspicuous angular bend, ventral margin very slightly sinuated in the middle, anterior extremity somewhat broader than the posterior, which is obtusely rounded, with the greatest curvature a little above the median axis; seen dorsally, ovate, with the greatest width about in the middle and slightly exceeding half the length, anterior extremity more narrowed than the posterior. Surface of shell smooth, with only small scattered pits, and clothed with comparatively short and delicate hairs more conspicuous at both extremities. Structure of the several appendages very like that in the type species.

Colour not yet ascertained.

Length of shell attaining 3 mm.

Remarks.—I think I am right in identifying the above-described form with that recorded by G. W. Müller, though some small differences may be found on comparing the figures here given with those in Müller's work. It is much the largest of the seven species here described, and indeed one of the largest known Ostracods, being in this respect only superseded by the two big species of the genus *Megalocypris*; to be described further below. On the accompanying plate carefully drawn figures of all the appendages in the present species are given for comparison with those in the other genera treated of in this paper.

Occurrence.—Some few specimens of this large Ostracod were contained in a sample taken September 1897 by the late Dr. Purcell from a pond on Green Point Common, near Cape Town. The specimens examined by G. W. Müller were derived from a vley at Plumstead.

2. EUCYPRIS PURCELLI, n. sp.

(Plate II, figs. 12-15.)

Specific Characters.—Shell comparatively more tumid than in the preceding species; seen laterally, of a rather regular oval reniform shape, greatest height about in the middle and only slightly exceeding half the length, dorsal margin quite evenly arched throughout, ventral

margins distinctly sinuated in the middle, both extremities rounded off, the posterior one having the greatest curvature somewhat below the median axis; seen dorsally, broadly oval in form, with the greatest width considerably exceeding half the length and about equalling the height, anterior extremity somewhat more pointed than the posterior. Surface of shell, as in the preceding species, nearly smooth and clothed with comparatively short and delicate hairs. Structure of the several appendages scarcely different from that in the preceding species.

Colour not yet ascertained.

Length of shell scarcely exceeding 2.30 mm.

Remarks.—The present species may be easily distinguished from the preceding one by the rather different shape of the shell, as also by its inferior size. Fig. 14 on the accompanying plate is given to show the natural position of the several appendages, and fig. 15 to show the inner duplicatures of the shell.

Occurrence.—Several specimens of this form were contained in an alcoholic sample taken by Dr. Purcell, August 26th, 1900, from a pond at Ashton, Robertson Division. Neither this nor the preceding species have been reared in my aquaria.

3. *EUCYPRIS PRODUCTA*, n. sp.

(Plate III, figs. 1 and 2.)

Specific Characters.—Shell moderately tumid; seen laterally, oblong oval in outline, greatest height only slightly exceeding half the length and occurring about in the middle, dorsal margin somewhat irregularly curved, with a slight indication of angle both in the middle and behind, ventral margin distinctly sinuated, both extremities somewhat produced, the anterior one obtusely rounded at the end and broader than the posterior, which appears somewhat obliquely deflexed, with the greatest curvature considerably below the median axis; seen dorsally, oval fusiform in outline, with the greatest width in the middle and nearly equalling the height. Sculpture of shell and structure of the several appendages about as in the two preceding species.

Colour pale greenish, with a rather broad marginal zone of a lighter hue in front, and with a very conspicuous dark stripe on each side running obliquely backwards from the centre of the shell, just above the caecal tubes of the intestine.

Length of shell amounting to 2.40 mm.

Remarks.—In its general appearance this form bears some resem-

blance to the European species, *E. virens*. It is, however, of larger size and has the shell more elongate, both extremities being considerably more produced, a character which has given rise to the specific name here proposed.

Occurrence.—Some few specimens of this form were reared* in one of my aquaria prepared with mud kindly forwarded to me in the year 1900 by Mr. Hodgson, and derived from a vley near Port Elizabeth.

4. EUCYPRIS CORPULENTA, G. O. Sars.

(Plate III, figs. 3 and 4.)

Cypris corpulenta, G. O. Sars. On some South African Entomostraca raised from dried mud. Chr. Vid. Selsk. Skrifter, 1895, p. 30, pl. v, fig. 2, a-c.

Specific Characters.—Shell very tumid; seen laterally, of a somewhat irregular rounded oval form, greatest height about in the middle and equalling $\frac{2}{3}$ of the length, dorsal margin rather evenly arched, ventral margin very slightly sinuated in the middle, anterior extremity obliquely rounded and scarcely as broad as the posterior, which is obtusely blunted, with the greatest curvature about in the median axis; seen dorsally, broadly oval in outline, with the greatest width about in the middle and fully attaining the height, anterior extremity more pointed than the posterior. Surface of shell rather densely hairy, the hairs being, as usual, more conspicuous at both extremities.

Colour yellowish-brown changing to olivaceous, and clouded dorsally with dark green.

Length of shell amounting to 2.10 mm.

Remarks.—This species was described and figured by the present author in the year 1895, and has more recently also been recorded by G. W. Müller. I am, however, by no means assured that the form so named by him is in reality referable to the present species, as the shape of the shell, to judge from the figures given by that author, appears somewhat different, and also the size is far inferior.

Occurrence.—The specimens originally examined by the present author were raised from mud taken at Knysna. I have not obtained this species from any other locality.

5. EUCYPRIS HIRTA, n. sp.

(Plate III, figs. 5 and 6.)

Specific Characters.—Shell moderately tumid; seen laterally, suboval in outline, greatest height scarcely attaining $\frac{2}{3}$ of the length

and occurring about in the middle, dorsal margin gently arched, ventral margin distinctly sinuated, both extremities bluntly rounded and nearly equal; seen dorsally, regularly ovate, with the greatest width in the middle and scarcely attaining the height, anterior extremity more pointed than the posterior. Surface of shell sculptured with rather closely set pits, and all over clothed with unusually coarse curved hairs, giving the shell a pronouncedly hirsute appearance.

Colour yellowish grey, with a more or less distinct greenish tinge dorsally, and an orange shadow in front.

Length of shell amounting to 1.90 mm.

Remarks.—The present form is chiefly characterised by the unusually strong development of the hairs clothing the shell, a character which indeed has given rise to the specific name here proposed. Otherwise it approached closely to *E. corpulenta*.

Occurrence.—Some specimens of this form, one of which is drawn on the accompanying plate, were found in the same sample in which *E. trichota* occurred (Green Point Common). Moreover, a number of specimens, apparently referable to the same species, though of somewhat smaller size, were reared in one of my aquaria prepared with mud from the neighbourhood of Bergvliet.

6. EUCYPRIS TRIGONA, G. O. Sars.

(Plate III, figs. 7 and 8.)

Cypris trigona, G. O. Sars. L.c. p. 32, pl. v, fig. 3, a-c.

Specific Characters.—Shell moderately tumid; seen laterally, of a pronouncedly trigonal shape, greatest height fully attaining $\frac{3}{5}$ of the length and occurring in the middle, dorsal margin boldly arched, being almost angularly bent in the middle and declining steeply to each extremity, ventral margin nearly straight, both extremities obliquely rounded and nearly equal; seen dorsally, regularly ovate, with the greatest width in the middle and not nearly attaining the height, anterior extremity more pointed than the posterior. Surface of shell nearly smooth and clothed with comparatively short and delicate hairs.

Colour pale greenish, clouded dorsally with irregular darker shadows, and exhibiting anteriorly a rather broad lighter marginal zone partly continued along the lower face.

Length of shell amounting to 1.75 mm.

Remarks.—This form was described by the present author at the same time as *E. corpulenta*, but has not been observed by me sub-

sequently. It is easily recognised from the other known species by the high, pronouncedly trigonal shell.

Occurrence.—Only two or three specimens of this form have hitherto come under my notice. They were found in one of my aquaria prepared with mud from the Knysna swamp.

7. EUCYPRIS CAPENSIS (G. W. Müller).

(Plate III, figs. 9 and 10.)

Cypris capensis, G. W. Müller. L.c. p. 153, figs. 1-6 (in text).

Specific Characters.—Shell very tumid; seen laterally, oblong reniform in outline, greatest height only slightly exceeding half the length and occurring rather in front of the middle, dorsal margin abruptly bent behind the ocular region and nearly straight in the middle, though obliquely declining, ventral margin deeply sinuated in the middle, both extremities somewhat deflexed and rounded off, the anterior one conspicuously broader than the posterior; seen dorsally, exceedingly broad and expanded, greatest width even considerably exceeding the height, anterior extremity narrowly produced, posterior obtuse. Surface of shell sculptured with rather densely set pits, and finely hairy at both extremities. Anterior legs with the penultimate and antepenultimate joints coalesced.

Colour not yet ascertained.

Length of shell amounting to 1.80 mm.

Remarks.—I cannot doubt that the above-described form is identical with that recorded by G. W. Müller, though the lateral aspect of the shell, as given by that author, appears somewhat shorter and stouter than in the specimens examined by me. In all other respects, however, I find the accordance quite complete.

Occurrence.—Some few specimens of this very distinct species were found in a sample taken by Dr. Purcell from a pond on Green Point Common. The specimens examined by G. W. Müller were derived from the same locality as *E. trichota*.

GEN. 2. PSEUDOCYPRIS, Daday, 1910.

Generic Characters.—Shell provided on each side of the ventral face with a projecting thin lamellar expansion encompassing, like a frame, its central part; dorsal face roof-like vaulted, ventral face flattened. Valves subequal, with the inner duplicatures not particularly broad. Natatory setae on the posterior antennae well developed.

Maxillary palp with the terminal joint narrow, cylindrical in form. Anterior legs with the penultimate and antepenultimate joints confluent. Caudal rami comparatively less slender than in *Eucypris*. Spermatic tubes in male forming dense coils both in the anterior and posterior parts of the valves.

Remarks.—This genus was proposed in the year 1910 by Daday to include a species (*P. Bouvieri*), observed by him in both sexes, and derived from the equatorial part of Africa. The most reliable distinguishing characters of this genus are to be derived from the shell, the appearance of which is indeed highly remarkable. The several appendages, on the other hand, do not exhibit any pronounced difference in their structure from those in the genus *Cypris* and *Eucypris*. The character on which Daday has laid most stress in establishing this genus, is the relation of the spermatic tubes in the male. As, however, as yet no males have been examined of any species either of *Eucypris* or *Cypris* proper, and accordingly the relation of the spermatic tubes in these genera is still unknown, the above-mentioned character cannot properly be utilised for the distinction of the present genus (see Addendum, p. 177).

8. PSEUDOCYPRIS TESTUDO, n. sp.

(Plate III, figs. 11–17.)

Specific Characters—*Female*.—Shell pronouncedly clypeate in shape, owing to the projecting lamellar expansion surrounding its ventral face; seen laterally, oblong triangular in outline, greatest height not nearly attaining half the length and occurring in front of the middle; dorsal margin evenly arched in front, sloping obliquely behind, and joining the posterior margin by a slight angular bend; ventral margin almost straight, without any obvious sinus in the middle; anterior extremity much broader than the posterior, and obliquely rounded, terminating below in a well-marked angular corner, posterior extremity rather produced and obtusely acuminate; seen dorsally, very broad, elliptical in outline, with the greatest width about equaling $\frac{4}{5}$ of the length and nearly twice the height, lateral edges evenly curved throughout. Surface of shell smooth, with only small and scattered pits, and rather sparingly clothed with delicate hairs.

Colour not yet ascertained.

Length of shell amounting to 2.40 mm.

Remarks.—The above-described peculiar Ostracod is evidently congeneric with the form examined by Daday, but is specifically

well distinguished by some rather conspicuous differences as to the shape and sculpture of the shell. It is also of much larger size.

Occurrence.—Some few female specimens of this remarkable form, chiefly detached valves, were found in the same sample in which *Eucypris capensis* occurred (Green Point Common). On the accompanying plate, in addition to the figures of the shell, some of the limbs have been drawn to show their close resemblance to those in *Eucypris* (see also Addendum, p. 179).

GEN. 3. LIOCYPRIS, n.

Generic Characters.—Shell compressed, smooth, higher behind than in front, with the valves thin and pellucid, subequal; inner duplication of anterior extremity very broad. Posterior antennae slender, with the natatory setae much reduced. Maxillae with the terminal joint of the palp scarcely longer than broad; masticatory lobes not much prolonged. Maxillipeds with the palps unusually large, lamellar, in female simple, in male, as usual, prehensile and very unequally developed. Anterior legs comparatively slender, with the penultimate and antepenultimate joints well defined. Caudal rami slender, linear. Genital lobes of female provided both in front and behind with a peculiar soft digitiform appendage. Copulative appendages of male large, lamelliform, without any distinctly marked chitinous ducts, and only slightly bilobular at the extremity. Ejaculatory tubes apparently absent.

Remarks.—This new genus is established to include a large Ostracod, which I am unable to refer to any of the hitherto known genera, exhibiting, as it does, some rather extraneous characters, especially as regards the male sex. The genus to which it shows the nearest relationship is perhaps *Homocypris* G. O. Sars.

9. LIOCYPRIS GRANDIS, n. sp.

(Plate XVIII, figs. 5–16.)

Specific Characters—Female.—Shell, seen laterally, oblong sub-reniform in outline, greatest height (in adult specimens) rather behind the middle and about equalling half the length, dorsal margin rather strongly arched in its posterior part, declining slowly in front, much more steeply behind, ventral margin almost straight, anterior extremity evenly rounded, posterior obliquely deflexed and terminating below in an obtuse corner; seen dorsally, narrow fusiform in

outline, with the greatest width only slightly exceeding $\frac{1}{3}$ of the length, both extremities obtusely pointed. Valves perfectly equal, thin and pellucid, without any obvious sculpture and finely hairy in front and behind, some of the hairs of the posterior extremity rather produced; inner duplicatures broad in front, narrow behind. Posterior antennae with the penultimate joint rather narrow and shorter than the antepenultimate one; apical claws not much elongated; natatory setae very much reduced, nearly obsolete. Maxillipeds unusually largely developed, though having the branchial plate comparatively small. Caudal rami very slender, almost straight; apical claws thin and somewhat unequal, the larger one scarcely exceeding half the length of the ramus.

Male of about same size as female and resembling it in the shape of the shell. Prehensile palp of right maxilliped with the dactylus very broad and quite lamellar, produced at the end to a narrow straight lappet; that of left palp with the dactylus more normally developed and abruptly bent at the base. Copulative appendages oblong oval in shape, and slightly cleft at the end, with the inner lobe obtuse, the outer narrow falciform.

Colour not yet ascertained.

Length of adult female reaching 4.40 mm.

Remarks.—In the lateral aspect this form exhibits a certain resemblance to a *Candona*, and indeed in habits it may also agree with the species of that genus, the animal being apparently quite devoid of swimming power. But an examination of the several appendages proves it at once to be very different. It is one of the largest Ostracoda known, and is in this respect only superseded by some of the species of the genus *Megalocypris*.

Occurrence.—Several specimens of this remarkable form, both adult and young ones, were collected by the late Dr. F. Purcell at Stompneus, Cape Province. Among the specimens a single fully adult male was present, with well-developed spermatocysts, but with the shell somewhat crushed. The appendages of the specimen were, however, sufficiently well preserved to allow a complete examination, which revealed some rather perplexing peculiarities, especially as regards the structure of the copulative apparatus.

GEN. 4. HETEROCYPRIS, Claus, 1892.

Remarks.—This genus was proposed in the year 1892 by Claus to include the well-known European species *Cypris incongruens*

Ramdohr, but has been rejected by most recent authors (also by myself), and identified with the genus *Cyprinotus* established at a somewhat earlier date by Brady. I am, however, now of opinion that these two genera, though closely related, ought to be kept apart, as they each comprise a number of species agreeing pretty well with each other. In all the known species of the present genus the shell exhibits a more or less bright yellow or orange colour, and they may indeed thereby, when examined in the living state, easily be recognised from the species of the genus *Cyprinotus*, and also from most other Ostracoda. Three species of the present genus will be described in the following pages, as members of the Fauna of the Cape Province.

10. HETEROCYPRIS INCONGRUENS (Ramdohr).

(Plate IV, figs. 1 and 2.)

Cypris incongruens, Ramdohr. Magaz. d. Gesellsch. naturf. Freunde in Berlin II, p. 86, pl. iii, figs. 1-12, 15, 16, 18-20.

Specific Characters.—*Female*.—Shell, seen laterally, irregularly ovate in outline and somewhat narrowed in front, greatest height exceeding half the length and occurring about in the middle, dorsal margin rather boldly arched and joining. The anterior and posterior edges without any intercrossing angle, ventral margin nearly straight, anterior extremity considerably narrower than the posterior, the latter obtusely rounded, with the greatest curvature about in the median axis of the shell; seen dorsally, oblong ovate, with the greatest width not merely attaining half the length and occurring somewhat behind the middle, anterior extremity more narrowed than the posterior. Valves, as in the other species of the present genus, conspicuously unequal, though less so than in the two succeeding species, right valve the smaller and distinctly overlapped in front by the left, exhibiting, moreover, the usual armature of closely set marginal tubercles easily observable both in front and behind. Surface of shell smooth and polished, being clothed in front and behind with very small and delicate hairs.

Colour more or less bright yellow, changing on the dorsal face to orange, on account of the translucent ripe ova, caecal tubes of the intestine not very conspicuous.

Length of shell amounting to 1.45 mm.

Remarks.—The present species was described as early as the year 1808 by Ramdohr, and has subsequently been examined by numerous

authors. It seems indeed to be a cosmopolitan species, having been recorded from almost all parts of the world, though in some cases it has perhaps been confounded with other nearly allied species.

Occurrence.—This Ostracod developed in great abundance in some of my aquaria prepared with mud taken by Dr. Purcell from a small grassy vley on the Cape Flats. Some alcoholic specimens have also been forwarded to me from the South African Museum, and these I have carefully compared with Norwegian specimens, without detecting any difference whatever. The male of this species has been described by Vávra. It seems to be extremely rare, and indeed I have myself never found any male among the numerous specimens examined. The present species seems accordingly as a rule to propagate in a parthenogenetical manner, like the species of the genera *Eucypris* and *Cypris* proper.

11. HETEROCYPRIS AUREA, G. O. Sars.

(Plate IV, figs. 3 and 4.)

Cypris aurea, G. O. Sars. L.c. p. 34, pl. v, fig. 4, a-c.

Specific Characters—*Female*.—Shell, seen laterally, subovate in outline, with the greatest height a little behind the middle, dorsal margin sloping gently in front and forming behind a bold and even curve, ventral margin without any obvious sinus, being even somewhat convex in its posterior part, anterior extremity obliquely rounded, posterior rather broad and blunted at the end, with a somewhat projecting rounded lappet below; seen dorsally, oblong cuneiform, gradually tapered in front to a slightly twisted rostral projection. Valves rather more unequal than in the type species, the left one considerably overlapping the right anteriorly, marginal tubercles of the latter well marked. Surface of shell smooth and clothed at each extremity with delicate hairs.

Male smaller than female, and on the whole resembling in appearance that of the succeeding species (see fig. 8).

Colour of female beautiful golden yellow, with a dark patch across the back, and the caecal tubes of the intestine likewise very dark coloured; ripe ova shining through the shell with a bright reddish-orange hue.

Length of the shell in female attaining 1.50 mm., that of male 1.30 mm.

Remarks.—This form was described by the present author in 1894, and its differences from the type species pointed out. The figures

given of both these species on the accompanying plate will still more clearly show these differences, as regards the shape of the shell.

Occurrence.—The specimens originally examined were raised from mud taken from the Knysna swamp, and this species has also been recorded by Daday (1913) from Kamaggas, Little Namaqualand. Most of the specimens were of the female sex; but among them also some male specimens occurred, one of which has been figured in the above-quoted Journal, together with some details.

12. HETEROCYPRIS CAPENSIS (G. W. Müller).

(Plate IV, figs. 5–20.)

Cyprinotus capensis, G. W. Müller. L.c. p. 162, figs. 1–6 (in text).

Specific Characters.—*Female*.—Shell, seen laterally, oval reniform in outline, greatest height somewhat in front of the middle, dorsal margin only slightly arched in the middle and joining both the anterior and posterior edges by an abrupt bend, ventral margin conspicuously sinuated in the middle, anterior extremity obliquely rounded and somewhat broader than the posterior, which terminates below in a somewhat projecting corner; seen dorsally, cuneiform in outline, with the anterior extremity narrowly produced and terminating in a beak-like prominence twisted to the right side. Valves very unequal, much more so than in any of the other known species, left valve projecting considerably beyond the right in front, marginal tubercles of the latter very conspicuous. Surface of shell smooth and clothed at both extremities with delicate hairs. Structure of the several appendages scarcely differing from that in the type species.

Male of smaller size than female, and easily recognisable by the densely crowded spermathecae shining through the valves in their posterior part. Shape of the shell slightly different, being comparatively shorter and stouter, with the ventral sinus less deep.

Colour of female pale yellow, more or less tinged dorsally with orange, owing to the translucent ripe ova.

Length of shell attaining in female 1.40 mm., in male 1.20 mm.

Remarks.—The above-described form is unquestionably identical with that recorded by G. W. Müller, though the remarkable inequality of the valves does not appear sufficiently from the figures given by that author. As to the specific name proposed by G. W. Müller, I find it somewhat objectionable, as this name had been given by the same author to a species of the nearly allied genus *Eucypris* (see above), and as, moreover, at a much earlier date, another Ostracod (*Cypria*

capensis G. O. Sars) had been named in a similar manner. Before knowing the work of G. W. Müller, I had noted this species under the provisional name *H. loxolabris*.

On the accompanying plate, figures of the several appendages in the present species are given for comparison with those in the other genera here treated of.

Occurrence.—This form developed rather abundantly in some of my aquaria prepared with mud taken by Dr. Purcell from old gravel-pits on the Bergvliet Flats. It was also reared from mud taken by Mr. Orjan Olsen in the year 1913 from small dried-up ponds near the whaling station at Saldanha Bay. Moreover, specimens of the same species were found in some of the alcoholic samples sent to me from the South African Museum, and taken in the neighbourhood of Cape Town.

GEN. 5. HOMOCYPRIS, n.

Generic Characters.—Shell moderately tumid, smooth, elongate, with both extremities conspicuously produced. Valves perfectly equal and without any armature, except the usual delicate coating of hairs; inner duplicatures remarkably broad, especially that of the anterior extremity. Natatory setae of the antennae less perfectly developed than in *Heterocypris*. Maxillary palp with the terminal joints narrow cylindric. Caudal rami of moderate size and armed in the usual manner. Prehensile palps of the maxillipeds in male very unequal, the terminal joint of the right one being very broad and expanded, that of the left one narrow unguiform. Ejaculatory tubes slender, with numerous chitinous whorls, and the distal end funnel-shaped. Outer lamella of the copulatory appendages tooth-shaped.

Remarks.—The present new genus is nearly allied to *Heterocypris*, differing however conspicuously in the shape of the shell, and more particularly in the valves, being perfectly equal and without any traces of marginal tubercles. The large size of the anterior duplicatures of the valves is also rather characteristic. The genus comprises as yet only a single species, to be described below.

13. HOMOCYPRIS CONOIDEA, n. sp.

(Plate V, figs. 1–11.)

Specific Characters—Female.—Shell, seen laterally, narrow oblong or somewhat conoid in outline, with the greatest height not attaining half the length and occurring somewhat behind the middle, dorsal

margin evenly arched and joining the anterior and posterior edges without any intervening angle, ventral margin distinctly sinuated in the middle, anterior extremity rather strongly produced and narrowly rounded at the end, posterior extremity considerably broader and obtusely blunted; seen dorsally, oblong oval in form, with the anterior extremity abruptly narrowed, the posterior obtuse. Surface of shell smooth and polished, with only scattered small pits, and clothed at both extremities with delicate hairs.

Male of smaller size than female, and easily recognisable by the densely coiled spermathecal tubes shining through the posterior part of the valves, form of shell about as in female, though somewhat more produced behind.

Colour bright yellow, changing on the dorsal face to orange.

Length of shell in female amounting to 1.35 mm.

Remarks.—The present form, when examined in the fresh state, may be easily mistaken for a species of *Heterocypris*, as it exhibits a very similar golden yellow colour. On a closer examination, however, it is found not only to differ essentially in the structure of the shell, but also in habits. Whereas the forms belonging to the genus *Heterocypris* are very active animals, swimming about in the water with great speed, the specimens of the present species are found almost constantly to keep at the bottom of the vessel in which they are watched, only quite exceptionally making a short trip through the water and in a rather slow manner.

Occurrence.—Numerous specimens of this form developed in some of my aquaria prepared with mud taken by Dr. Purcell from old dried-up pits on the Bergvliet Flats. It was also reared, though less abundantly, from the mud kindly forwarded to me from Mr. Hodgson, and taken at Port Elizabeth.

GEN. 6. CYPRICERCUS, G. O. Sars, 1894.

Remarks.—This genus was established by the present author in the year 1894, and was chiefly characterised by the unusually powerful development of the caudal rami, as indicated by the generic name proposed. Also, otherwise, this genus distinguishes itself pretty well; e.g. by the peculiar manner in which the spermathecal tubes of the male are curled up in the anterior part of the valves. In addition to the type species, another nearly allied form, first recorded by G. W. Müller, will be described later; and I have also had an opportunity of examining two other species unquestionably referable to the

same genus, the one from Algeria, the other from Australia. Moreover, I am much inclined to believe that the four European species, *Cypris fuscata*, *affinis*, *elliptica*, and *obliqua*, ought more properly to be adduced to the present genus.

14. CYPRICERCUS CUNEATUS, G. O. Sars.

(Plate V, figs. 12-19.)

Cypricercus cuneatus, G. O. Sars. L.c. p. 33, pl. vi, fig. 1, *a-h*.

Specific Characters—*Female*.—Shell very tumid; seen laterally, oblong cuneiform, tapering behind to an obtuse point, greatest height not attaining half the length and occurring rather in front of the middle, dorsal margin gently arched and sloping evenly behind, ventral margin scarcely at all sinuated, being, on the contrary, somewhat convex in the greater part of its extent, anterior extremity much broader than the posterior and evenly rounded at the end, posterior extremity drawn out to an obtuse point; seen dorsally, broadly ovate in outline, with the greatest width fully attaining half the length and occurring behind the middle, both extremities obtusely pointed. Valves conspicuously unequal, the left one overlapping the right along the whole anterior extremity, as also somewhat ventrally, being however at the end of the posterior extremity slightly overlapped by the right one. Surface of shell smooth and clothed at each extremity with delicate hairs. Caudal rami very largely developed, attaining nearly half the length of the shell.

Male somewhat smaller than female, but exhibiting a much similar shape of the shell.

Colour in female light yellow, with a greenish tinge, that in male more ochraceous.

Length of shell amounting in female to 1.60 mm.

Remarks.—The present species being that on which the genus *Cypricercus* originally was founded, ought accordingly to be regarded as the type of that genus. It is easily distinguished from the other species by the shape of the shell and by the exceedingly powerful development of the caudal rami.

Occurrence.—The specimens of this form originally examined were reared from mud taken at Knysna. A few female specimens were also found in one of my aquaria prepared with mud taken by Dr. Purcell near Bergvliet.

15. CYPRICERCUS EPISPHAENA, G. W. Müller.

(Plate IV, figs. 20-28.)

Cypricercus episphaena, G. W. Müller. L.c. p. 155, figs. 1-8 (in text).

Specific Characters—Female.—Shell less tumid than in the preceding species, seen laterally, suboval in outline, with a very conspicuous hump-shaped prominence issuing from the hind extremity, greatest height not attaining half the length and occurring about in the middle, dorsal margin only slightly arched and sloping gently behind, ventral margin scarcely sinuated, anterior extremity obtusely rounded, posterior somewhat narrower and drawn out in the middle to the above-mentioned hump-shaped prominence; seen dorsally, oblong oval in outline, with the greatest width about in the middle and not attaining the height, both extremities somewhat irregularly produced at the end. Valves, as in the preceding species, conspicuously unequal, the left one overlapping the right along the whole anterior edge, whereas behind it is considerably overlapped by the right valve, the above-mentioned hump-shaped prominence being in reality exclusively formed by that valve. Surface of shell smooth and only sparingly hairy, the hairs being more conspicuous on the anterior edges. Caudal rami somewhat less powerful than in the type species, but otherwise of a very similar structure.

Male resembling the female in the general shape of the shell, but of somewhat smaller size, and easily recognisable by the translucent spermathecal tubes. Ejaculatory tubes comparatively shorter than in *C. cuneatus*, but of a similar structure, their proximal ends being bladder-like produced. Outer lamellae of the copulatory appendages produced at the end to two claw-like processes.

Colour dark yellowish brown, with a faint ochraceous tinge at each extremity.

Length of shell amounting in female to 1.60 mm.

Remarks.—I cannot doubt that the above-described form is identical with that recorded by G. W. Müller, though the figures given by that author of the shell do not fully agree with those here reproduced. The species may at once be distinguished from the other known forms by the peculiar hump-shaped prominence issuing from the hind extremity of the shell, a character which indeed induced me to note this form under the provisional name *C. caudatus*, before knowing the work of G. W. Müller.

Occurrence.—Numerous specimens of this species were contained

in one of the alcoholic samples forwarded to me from the South African Museum, and taken from a pond on Green Point Common. I have also had an opportunity of examining this form in the living state, having succeeded in raising some specimens from a parcel of mud taken in about the same locality. The specimens examined by G. W. Müller were collected at Plumstead.

16. *CYPRICERCUS MACULATUS*, G. W. Müller.

(Plate XIX, figs. 8-13.)

Cypricercus maculatus, G. W. Müller. Deutsche Südpolar Expedition, Ostracoda, p. 157, figs. 1-9 (in text).

Specific Characters.—*Male*.—Shell, seen laterally, oval in outline, slightly narrowed behind, greatest height in the middle and about equalling half the length, dorsal margin only slightly arched in its anterior part, but obliquely declining behind, ventral margin scarcely at all sinuated, anterior extremity broadly rounded, posterior obtusely produced; seen dorsally, regularly elliptical in shape, with the greatest width about half the length. Valves somewhat unequal, the left one overlapping the right in front by a rather broad and sharply defined border. Surface of shell smooth, with only slight traces of hairs. Posterior antennae very slender, with the penultimate joint distinctly subdivided in the middle. Prehensile palp of right maxilliped with the dactylus comparatively short and stout. Copulative appendages with the outer lamella small, terminating in an incurved lappet. Caudal rami rather largely developed and slightly flexuous; apical claws somewhat unequal, the larger one but little exceeding in length $\frac{1}{3}$ of the ramus.

Colour (in preserved specimens) yellowish grey, variegated with a number of very conspicuous dark green patches extending more or less down the sides of the shell.

Length of adult male 1.50 mm.

Remarks.—The above-described form is unquestionably that recorded by G. W. Müller. It is closely allied to the type species *C. cuneata* G. O. Sars, but has the posterior corner of the shell less produced, and is, moreover, at once distinguished by the dark patches clothing the shell dorsally, and very conspicuous even in preserved specimens.

Occurrence.—Two specimens of this form, both of the male sex, were in the material received. They were taken from a pond on the Cape Flats, collected by Mr. K. H. Barnard.

GEN. 7. STENOCYPRIS, G. O. Sars, 1889.

Remarks.—This genus was established as early as the year 1889 by the present author to include an Ostracod (*S. Malcolmsoni*) raised by him from Australian mud, and previously recorded by Baird and Brady from India. In recent times several additional species have been recorded from different parts of the world, but it is somewhat questionable if they all are in reality congeneric. The most prominent character distinguishing the present genus is unquestionably the structure of the caudal rami, which is very peculiar and unlike that in any other Ostracoda. I have found it perfectly constant in all the species examined by me, with only very slight modifications, and this character may accordingly be regarded as quite conclusive for the recognition of this genus. Seven species, belonging to the Fauna of the Cape Province, and one from the Transvaal, will be described below.

17. STENOCYPRIS HODGSONI, n. sp.

(Plate VI, figs. 1–12.)

Specific Characters—*Female*.—Shell much compressed; seen laterally, elongate reniform in outline, greatest height about in the middle and scarcely exceeding $\frac{2}{3}$ of the length, dorsal margin nearly straight in the middle and declining slowly in front, somewhat more steeply behind, ventral margin deeply sinuated, both extremities obliquely deflexed and rounded at the end; seen dorsally, narrow fusiform, with the greatest width scarcely attaining $\frac{1}{3}$ of the length, both extremities acutely pointed. Valves rather thin and pellucid, without any thickened marginal zone, and nearly equal, inner duplication of the anterior extremity remarkably broad. Surface of shell smooth, with only small scattered pits, and exhibiting in front the usual dense clothing of delicate hairs, posterior extremity, however, provided with scattered hairs of very unequal size, some of them being remarkably slender and pointing in different directions. Caudal rami, as in the other species of this genus, conspicuously asymmetrical, the right ramus being much narrower than the left, the dorsal edge of which is divided in a comb-like row of coarse denticles gradually increasing in size distally; apical claws of both rami densely denticulate along the concave edge, the denticles of the outer half being somewhat smaller than those on the inner; dorsal setae wanting.

Male of nearly same size as female, and resembling it in the general shape of the shell. Prehensile palps of maxillipeds not much unequal.

Ejaculatory tubes of a similar structure to those in *S. smaragdina*, as represented in fig. 24 on the accompanying plate. Outer lamella of the copulatory appendages forming at the base outside an obtusely acuminate corner, the extremity being broadly spatulate in shape.

Colour in female light yellowish green, somewhat darker dorsally, ripe ova shining through the shell by a vivid reddish-orange hue.

Length of shell amounting to 2.70 mm.

Remarks.—The above-described form is easily distinguished from the type species *S. Malcolmsoni*, by the more pronouncedly reniform shape of the shell and by the less strongly chitinated valves. It is also of considerably larger size. On the accompanying plate the several appendages in this species are drawn for comparison with those in the other genera here treated of.

Occurrence.—This form was reared in great numbers from the mud kindly forwarded to me from Mr. Hodgson, and taken from a vley near Port Elizabeth. It also occurred in some of the alcoholic samples sent to me from the South African Museum (Cape Flats), and a few specimens of the same species were, moreover, raised from mud taken by Mr. Orjan Olsen near the whaling station at Saldanha Bay.

18. *STENOCYPRIS OLIVACEA*, n. sp.

(Plate VI, figs. 13–18.)

Specific Characters.—*Female*.—Shell, seen laterally, oblong reniform in outline, with the greatest height somewhat exceeding $\frac{2}{3}$ of the length, dorsal margin very slightly curved in the middle and abruptly bent in the ocular region, declining also rather steeply behind, ventral margin deeply sinuated, both extremities obliquely deflexed, the posterior one forming below a well-marked angle, which in most cases is drawn out to an acute spur-like process; seen dorsally, narrow fusiform, with the greatest width about equalling $\frac{1}{3}$ of the length and occurring a little behind the middle, both extremities acuminate. Valves slightly unequal, the spur-like process of the posterior extremity being only formed by the right valve. Surface of shell smooth and rather densely hairy in front, the hairs of the posterior extremity more scattered, but of greater length. Caudal rami of a structure very similar to that in the preceding species.

Male resembling the female both in size and in the general shape of the shell, but easily recognisable by the densely coiled spermat-

tubes shining through the posterior part of the valves. Prehensile palps of maxillipeds with the terminal claw-like joint comparatively larger and more lamellar than in the preceding species. Outer lamella of the copulatory appendages without any basal prominence.

Colour in both sexes dark olivaceous brown.

Length of shell amounting to 2.70 mm.

Remarks.—In size and general appearance this form bears some resemblance to the preceding species. The shell is, however, comparatively less elongated, and its posterior extremity rather unlike in shape. Moreover, the colour is very different in the two species.

Occurrence.—Some specimens of this form were reared in one of my aquaria prepared with mud taken by Dr. Purcell from a small pool on the Cape Flats, alongside the railway line between Retreat and Lakeside.

19. *STENOCYPRIS SMARAGDINA*, n. sp.

(Plate VI, figs. 19–24.)

Specific Characters—Female.—Shell less distinctly reniform than in the two preceding species, seen laterally, irregularly oblong oval in outline, with the greatest height somewhat behind the middle and considerably exceeding $\frac{2}{3}$ of the length, dorsal margin gently arched in the middle and somewhat bent in the ocular region, sloping evenly behind, ventral margin only very slightly sinuated in front of the middle, anterior extremity evenly rounded off, posterior somewhat deflexed and terminating below in an obtuse corner; seen dorsally, subfusiform in shape, with the greatest width about $\frac{1}{3}$ of the length and occurring in front of the middle, posterior extremity somewhat narrower produced than the anterior. Valves nearly equal and rather thin and pellucid. Surface of shell smooth and all over clothed with rather strong hairs, those on the posterior extremity not differing from the others. Caudal rami of a structure very similar to that in the two preceding species, though perhaps a little more slender.

Male about the size of the female and resembling it in the general shape of the shell. Prehensile palps of maxillipeds nearly perfectly equal. Ejaculatory tubes slender, with numerous chitinous whorls and the proximal ends tuberculiform produced. Outer lamella of the copulatory appendages with a rather prominent acuminate lappet at the base, outside.

Colour in both sexes bright emerald green.

Length of shell amounting to 3·00 mm.

Remarks.—The present species is easily distinguished from the two preceding ones by the rather dissimilar shape of the shell, and, when examined in the living state, also by its beautiful green colour. It is the largest of the species as yet known, except *pectinata*.

Occurrence.—Several specimens, both males and females, of this handsome form were reared in one of my aquaria prepared with mud taken by Dr. Purcell from a grassy dried-up vley on the Cape Flats. Like the other species of the present genus, the animal is enabled to move rather quickly through the water, though more frequently it is found to keep to the bottom of the vessel in which it is observed, running about through the loose mud in search of food.

20. *STENOCYPRIS PARDALIS*, n. sp.

(Plate VII, figs. 1 and 2.)

Specific Characters—*Female.*—Shell much compressed; seen laterally, of a narrow, somewhat lanceolate shape, with the greatest height only slightly exceeding $\frac{1}{3}$ of the length, dorsal margin almost straight in the middle and sloping slowly in front, more steeply behind, ventral margin scarcely at all sinuated, anterior extremity, in most of the specimens, produced above the median axis to a small dentiform corner, below which the edge curves obliquely backwards, posterior extremity deflexed and produced below in a more or less developed acute spur-like process; seen dorsally, very narrow, the greatest width scarcely exceeding $\frac{1}{4}$ of the length, both extremities acuminate. Valves slightly unequal, the anterior dentiform corner, as also the spur-like process behind, being exclusively formed by the left valve. Surface of shell smooth and polished, being clothed along the lower part of the anterior extremity with delicate curved hairs, behind with more scattered hairs, some of which are of considerable length. Structure of the several appendages scarcely exhibiting any more conspicuous difference from that in the preceding species.

Male resembling the female in its general appearance, but exhibiting the usual sexual differences.

Colour very peculiar and unlike that in most other Ostracoda, the shell being all over mottled with somewhat irregular dark pigmentary specks strongly contrasting with the pale yellowish-grey ground colour of the shell.

Length of shell measuring 2·60 mm.

Remarks.—This is a very distinct and easily recognisable species,

being well distinguished by the narrow lanceolate shape of the shell, and more particularly by its very peculiar colour, which even in specimens preserved for a long time in alcohol is well observable. The specific name here proposed alludes to this latter character.

Occurrence.—Several specimens of this pretty species were reared from the same parcel of mud (Cape Flats) which yielded *S. smaragdina*. It also occurred in one of the alcoholic samples sent to me from the South African Museum, and taken from a pond on the Cape Flats. The animal is very active in its movements, swimming about with great speed, now and then attaching itself to the walls of the vessel in which it is watched.

21. STENOCYPRIS PERARMATA, Brady.

(Plate VII, figs. 3 and 4.)

Stenocypris perarmata, Brady. Entomostraca collected in Natal by Mr. J. Gibson. Proc. Zool. Soc. London, 1904, vol. ii, p. 126, pl. viii, figs. 50–57.

Specific Characters—Female.—Shell much compressed; seen laterally, narrow oblong in outline, with the greatest height scarcely attaining $\frac{2}{3}$ of the length, dorsal margin nearly straight in the middle, sloping slowly in front, more steeply behind, ventral margin nearly straight, anterior extremity narrowly rounded, posterior scarcely deflexed and obtuse at the end; seen dorsally, oblong lanceolate in form, with both extremities acuminate. Valves subequal and rather pellucid, unarmed. Surface of shell smooth and clothed in front and behind with delicate hairs.

Colour not yet ascertained.

Length of shell amounting to 2.00 mm.

Male unknown.

Remarks.—I am not quite assured that the above-described form is in reality identical with Brady's species, as it seems to differ a little in the shape of the shell, to judge from the figure given by that author. It cannot, however, be referred to any of the four species described in the preceding pages, and as the differences from Brady's species in any case are of a very trifling nature, I have not felt justified to establish a new species for its reception.

Occurrence.—Two female specimens of this form were found in one of the alcoholic samples sent to me from the South African Museum, and taken in the neighbourhood of Cape Town by Mr. K. H. Barnard.

Distribution.—Natal (Brady); Central Africa (the present author).

22. STENOCYPRIS PECTINATA, n. sp.

(Plate XIX, figs. 14-17.)

Specific Characters—Female.—Shell much compressed; seen laterally, oblong semilunar in outline, greatest height about in the middle and not fully attaining half the length, dorsal margin evenly arched, ventral very slightly sinuated in front of the middle, anterior extremity obliquely rounded, posterior deflexed and terminating below in a rather prominent, though obtusely pointed corner; seen dorsally, narrow lanceolate, with the greatest width scarcely exceeding $\frac{1}{4}$ of the length. Valves subequal, thin and pellucid, without any obvious sculpture and only sparingly hairy; posterior corner of each valve armed with a row of five very small denticles. Caudal rami, as usual, conspicuously asymmetrical, the left one being much narrower than the right and only very minutely spinulose along the outer part of the dorsal edge. Right ramus nearly straight, with the dorsal edge divided into nine remarkably slender and somewhat distant spiniform denticles, all of about same size, and followed proximally by only a few very small spinules; apical claws of both rami moderately strong and denticulated in the usual manner, the larger one nearly twice as long as the other, but scarcely exceeding in length $\frac{1}{3}$ of the ramus.

Colour not yet ascertained.

Length of adult female reaching 3.40 mm.

Remarks.—In size and general appearance this form somewhat resembles *S. aldebrae* of G. W. Müller, and indeed at first I believed it to be that species. On a closer examination I have, however, found it to differ very decidedly in some points, and more particularly in the armature of the right caudal ramus, which is rather peculiar and unlike that in any other species known to me.

Occurrence.—Several specimens of this form, all of the female sex, are in the material received, having been collected in the Transvaal by Mr. R. W. E. Tucker.

23. STENOCYPRIS DECLIVIS, n. sp.

(Plate XIX, figs. 18-20.)

Specific Characters—Female.—Shell, seen laterally, narrow subreniform in outline, greatest height behind the middle and scarcely exceeding $\frac{2}{5}$ of the length, dorsal margin straight in the middle, but abruptly bent behind and obliquely sloping to the hind corner, ventral

margin distinctly sinuated in the middle, anterior extremity narrowly rounded, posterior obliquely deflexed and gradually tapered below to a rather projecting obtuse corner; seen dorsally, narrow oblong, with the greatest width about equalling $\frac{1}{3}$ of the length. Valves subequal, finely hairy in front and clothed behind with scattered hairs of greater length. Right caudal ramus armed along the outer part of the dorsal edge with numerous closely set and comparatively delicate denticles gradually diminishing in size proximally; apical claws very unlike in size, the proximal one being scarcely half as long as the distal one and rather more curved.

Colour (in preserved specimens) uniformly dark green.

Length of adult female 2.60 mm.

Remarks.—This form is closely allied to *S. Hodgsoni* G. O. Sars (see the chief account), differing however somewhat in the shape of the shell, as also apparently in colour.

Occurrence.—Three well-preserved female specimens of this form are in the material received, having been taken from a pond on the Cape Flats, collected by Mr. K. H. Barnard.

24. STENOCYPRIS AMETRA, G. W. Müller.

(Plate XIX, figs. 21–23.)

Stenocypris ametra, G. W. Müller. Deutsche Südpolar Expedition, Ostracoda, p. 171, figs. 1–6 (in text).

Specific Characters.—*Female*.—Shell, seen laterally, oblong oval in outline, greatest height in the middle and slightly exceeding $\frac{2}{5}$ of the length, dorsal margin forming throughout a quite even and gentle curve, ventral margin slightly sinuated in the middle, anterior extremity rounded off, posterior obliquely deflexed and drawn out below to an acutely produced corner; seen dorsally, oblong fusiform, with the greatest width about equalling $\frac{1}{3}$ of the length and occurring somewhat in front of the middle. Valves slightly unequal, the anterior edge of the left one projecting a little beyond that of the right and forming above the middle an angular corner, hind extremity of same valve produced to a well-marked spiniform process. Surface of shell smooth and polished, finely hairy at each extremity. Right caudal ramus armed in its outer part dorsally with numerous densely crowded delicate denticles rapidly diminishing in size proximally and not fully extending to the middle of the ramus; apical claws comparatively slender and less unequal than in the two preceding species, the larger one about equalling in length half the ramus.

Colour (of the preserved specimen) uniformly whitish grey, without any traces of dark specks.

Length of the specimen examined 2.90 mm.

Remarks.—I think I am right in identifying the above-described form with Müller's species, though the figure of the shell (lateral aspect) given by that author does not fully agree with that drawn on the accompanying plate. The species is closely allied to *S. pardalis* G. O. Sars (see the chief account), but is of considerably larger size and also of a less narrow shape. Moreover, I have failed to detect even the slightest trace of the characteristic dark specks ornating the shell in *S. pardalis*.

Occurrence.—A solitary female specimen of this form was found in one of the samples sent to me from the South African Museum, and taken from a pond on the Cape Flats by Mr. K. H. Barnard.

GEN. 8. SCLEROCYPRIS, n.

Generic Characters.—Shell not much tumid, subclavate in shape, and of rather a heavy consistency, exhibiting a well-marked granular sculpture. Valves subequal, with the anterior edges very broad and peculiarly deflexed below, inner duplicatures strongly marked, though not particularly broad. Natatory setae of the posterior antennae not much elongated. Maxillae with the terminal joint of the palp broader than long, masticatory lobes very short and stout. Caudal rami slender, resembling somewhat those in the genus *Eucypris*. Propagation bisexual.

Remarks.—The present new genus is only founded on a single species, which I am unable to refer to any of the other known genera. It is chiefly distinguished by the unusually heavy consistency of the shell, a character which indeed has given rise to the generic name here proposed. The genera which seem to come nearest it are *Eucypris* and *Chlamydotheca*; but it is found to differ from either of them, not only in the structure of the shell, but also in that of some of the appendages. Moreover, the pronouncedly bisexual nature may be adduced as a distinctive character of the present genus.

25. SCLEROCYPRIS CLAVULARIS, n. sp.

(Plate VII, figs. 5–17.)

Specific Characters—*Female.*—Shell, seen laterally, oval quadrangular or more properly somewhat clavate in outline, with the

greatest height quite in front and about equalling half the length, dorsal margin obliquely declining in the middle and forming just above the ocular region an abrupt angular bend, ventral margin nearly straight, anterior extremity broadly rounded and expanding below to a projecting lobe, posterior extremity obliquely produced, with the lower corner obtusely rounded; seen dorsally, oval fusiform in outline, with the greatest width about equalling $\frac{2}{3}$ of the length, both extremities pointed. Valves rather opaque and nearly perfectly equal, each with a rather broad pellucid border in front; inner duplicatures of about equal width in front and behind, and defined inside by a thickened chitinous rim which appears particularly strong just behind the ventrally projecting lobe of the anterior extremity. Surface of shell sculptured with closely set pits, and rather densely hairy at both extremities. Caudal rami rather slender and slightly attenuated distally, with the outer part of the dorsal edge very finely spinulose; terminal claws and setae of the usual appearance.

Male fully as large as female and having the shell a little more elongate. Prehensile palps of maxillipeds quite equal on both sides, proximal joint produced inside to a well-marked thumb-like process, distal joint claw-like. Ejaculatory tubes surrounded by a hyaline envelope and each provided with numerous chitinous whorls, proximal and somewhat funnel-shaped. Copulatory appendages of a structure very similar to that in *Stenocypris*.

Colour dark olivaceous, clouded with irregular band-like patches of a deep green hue.

Length of shell amounting to 2.80 mm.

Remarks.—The above-described form cannot be confounded with any of the other known Ostracoda, exhibiting, as it does, some rather conspicuous peculiarities, both as to the appearance of the shell and the structure of some of the appendages. It belongs to the larger-sized forms of the present family.

Occurrence.—Some specimens of this interesting Ostracod were raised from a parcel of mud kindly sent to me from the South African Museum, and taken from a vley at Klipdam, near Kimberley. As a rule, the specimens kept at the bottom of the aquarium in which they were watched, burying themselves more or less deeply in the loose mud, and only quite occasionally one or other of them was seen making a short swimming trip, the heavy weight of the shell apparently impeding a more free motion. Unlike what is generally the case, most of the specimens obtained were of the male sex.

GEN. 9. HERPETOCYPRIS, Brady and Norman.

Remarks.—This genus, the type of which is the well-known European species *Cypris reptans* Baird, was originally only based on a single character, viz. the want (or rudimentary state) of the natatory setae on the posterior antennae, and the consequent loss of the swimming power. In accordance therewith, several heterogeneous species were at first adduced to this genus, which now is taken in a much more restricted sense than done by its founders. One species, undoubtedly referable to the present genus, is represented in the Fauna of the Cape Province, and will be described below.

26. HERPETOCYPRIS CHEVREUXI, G. O. Sars.

(Plate VII, figs. 18–22.)

Stenocypris Chevreuxi, G. O. Sars. Arch. f. Mathem. u. Naturv. f. 1896, p. 5, pls. i and ii.

Syn. : *Erpetocypris Helenae*, G. W. Müller.

Specific Characters—*Female*.—Shell, seen laterally, of a narrow oblong reniform shape, with the greatest height scarcely exceeding $\frac{2}{3}$ of the length, dorsal margin in the greater part of its extent perfectly straight and horizontal, declining, slowly in front, more steeply behind, ventral margin slightly sinuated, anterior extremity obliquely rounded and somewhat deflexed below, posterior a little broader than the anterior and obtuse at the end; seen dorsally, narrow oblong in shape, with the greatest width scarcely attaining $\frac{1}{3}$ of the length and occurring somewhat behind the middle, both extremities obtusely pointed. Valves, as in the type species, conspicuously unequal, the left one overlapping the right considerably both in front and behind, as also somewhat along the ventral face. Surface of shell smooth and polished, clothed at both extremities with hairs, those on the hind extremity remarkably prolonged and less densely crowded. Natatory setae on the posterior antennae well defined and extending nearly to the ends of the apical claws, being however very thin and scarcely at all plumose. Caudal rami rather powerfully developed and perfectly symmetrical, with the base somewhat dilated and the outer part sublinear in form, dorsal edge clothed in its outer half with small spinules arranged in regular groups; apical claws comparatively short and distinctly denticulate on their concave edge.

Colour more or less olivaceous, clouded with dark green.

Length of shell amounting to 2.30 mm.

Remarks.—This form was described in the year 1896 by the present author from specimens raised out of dried mud from Algeria, but was at that time erroneously referred to the genus *Stenocypris*, on account of the presence on the posterior antennae of distinctly developed natatory setae, such setae being presumed to be wanting in *Herpetocypris*. I am, however, now convinced that this form ought in reality to be included in the latter genus, as it otherwise shows a very close relationship to the type species *H. reptans*. The form recorded by G. W. Müller as *Erpetocypris Helenae* is unquestionably identical with the present species.

Occurrence.—This Ostracod developed in great abundance in some of my aquaria prepared with mud taken by the late Dr. Purcell from a vley on the Cape Flats. The specimens were as a rule only found on the bottom of the aquaria, running rather quickly through the loose mud in search of food. In some cases, especially when the aquaria were exposed to the direct sunlight, they were seen ascending up the walls of the aquaria and even to move for a short space freely in the water, though in a rather slow and clumsy manner. All the specimens examined were of the female sex, and as I have watched this form during several years and in numerous successive generations, without detecting even a single male, it may be proved that this form, like the type species, propagates in an exclusively parthenogenetical manner.

GEN. 10. MEGALOCYPRIS, G. O. Sars, 1898.

Remarks.—This genus was established in the year 1898 by the present author to include two big species of Ostracoda derived from the Cape Colony, the one of which (*M. princeps*) was described and figured in detail. The genus is somewhat allied to *Herpetocypris*, differing however in certain points decidedly, both as regards the structure of the shell and that of the appendages.

27. MEGALOCYPRIS D'URBANI (Baird).

(Plate VIII, figs. 1–16.)

Cypris d'Urbani, Baird. Description of some new species of Entomostraca. Ann. and Mag. Nat. Hist. 1862, p. 2, pl. i, fig. 1, a–b.

Syn. : *Megalocypris Hodgsoni*, G. O. Sars.

Specific Characters—*Female*.—Shell somewhat tumid; seen laterally, oval reniform in outline, greatest height about equalling half the

length and occurring rather behind the middle, dorsal margin angularly bent in the ocular region and nearly horizontal in the middle, joining the hind extremity by a very bold and quite even curve, ventral margin slightly sinuated in the middle, anterior extremity evenly rounded, posterior somewhat produced and obliquely deflexed, terminating below in an obtuse corner; seen dorsally, oval fusiform, with the greatest width about equalling $\frac{2}{3}$ of the length, both extremities acutely pointed. Valves rather thin and perfectly equal, with the inner duplicatures not particularly broad. Surface of shell nearly smooth, though exhibiting, under a high magnifying power, a finely granular sculpture, and rather densely clothed with delicate hairs more conspicuous at each extremity. Natatory setae of the posterior antennae quite rudimentary, being replaced by a bundle of extremely small bristles. Caudal rami slender and attenuated, with the outer half of the dorsal edge clothed with minute spinules arranged in regular groups; apical claws rather narrow and not much unequal in size.

Male nearly of same size as female and having the shell of a rather similar shape, but easily recognisable by the densely coiled spermathecae shining through the posterior part of the valves. Prehensile palps of maxillipeds very largely developed and pronouncedly cheliform, the proximal joint being considerably expanded and produced inside to a prominent thumb-like process against which the claw-like distal joint admits to be impinged, the latter joint slightly unlike on each side, that on left palp being produced to a very thin point. Ejaculatory tubes comparatively small, with numerous chitinous whorls and the proximal ends somewhat funnel-shaped. Copulatory appendages large, with the outer lamella very broad, triangular.

Quite young specimens (see fig. 4) rather unlike the adults, having the anterior part of the shell much higher than the posterior, and the valves armed along the anterior edge and part of the inferior one with densely crowded coarse denticles.

Colour of adult animal yellowish brown changing to olivaceous, with an irregular dark shadow in front of the middle; caecal tubes of intestine very conspicuous and bounded on each side by a narrow dark stripe.

Length of shell amounting to 5.20 mm.

Remarks.—This form was announced, but not described, by the present author as a new species under the name of *M. Hodgsoni*. It has, however, turned out to be identical with a form long ago recorded

by Baird, and the specific name proposed by me must, of course, be replaced by that originally given to the species by Baird.

Occurrence.—This big Ostracod was reared in considerable numbers from the mud kindly forwarded to me from Mr. Hodgson, and derived from a vley near Port Elizabeth. Some specimens were also raised from mud taken in the neighbourhood of Cape Town, and the specimens originally examined by Baird were likewise from that region. The animal is quite devoid of swimming power and is, of course, only found on the bottom, over which it crawls with great dexterity, at times burrowing more or less deeply within the loose mud. Male specimens are met with nearly as frequently as females.

28. MEGALOCYPRIS PRINCEPS, G. O. Sars.

(Plate VIII, figs. 17 and 18.)

Megalocypris princeps, G. O. Sars. On a gigantic Fresh-water Ostracod. Arch. f. Mathem. u. Naturv. vol. xx, No. 8, p. 5, with a plate.

Specific Characters—Female.—Shell comparatively more tumid than in the preceding species, and, seen laterally, of a somewhat more elongated shape, with the greatest height not attaining half the length, dorsal margin quite straight in the middle and angularly bent in front, joining the posterior edge by a quite even curve, ventral margin rather deeply sinuated, anterior extremity evenly rounded, posterior obtusely produced in the middle; seen dorsally, broadly fusiform in outline, with the greatest width exceeding $\frac{2}{3}$ of the length and nearly attaining the height, both extremities abruptly contracted and acuminate. Valves rather opaque, of a dull appearance, and clothed with very short hairs. Structure of the several appendages very similar to that in the preceding species.

Male a little smaller than female, but resembling it in the general shape of the skull.

Colour in female light yellowish grey, clouded in some places with green; in male somewhat darker.

Length of shell attaining 7.70 mm.

Remarks.—This form was described and figured in detail by the present author in the above-quoted Journal, as the type of the genus *Megalocypris*. It is perhaps the largest of all hitherto known Ostracoda, and thus fully deserves the specific name proposed. From the preceding species, to which it bears a very close relationship, it may be distinguished, in addition to its larger size, by the comparatively

more elongated form of the shell, the posterior extremity of which is also of a somewhat different shape.

Occurrence.—The specimens originally examined were contained in an alcoholic sample sent to me from the South African Museum, and taken September 1897 from a pond on Green Point Common. I have also had an opportunity of examining this splendid Ostracod in the fresh and living state, some specimens being successfully reared in my aquaria from mud taken in about the same place.

29. *MEGALOCYPRIS HISPIDA*, n. sp.

(Plate XX, figs. 16–22.)

Specific Characters—*Female*.—Shell elongate and rather tumid; seen laterally, narrow subreniform in outline, and somewhat contracted in the middle, greatest height not nearly attaining half the length, dorsal margin slightly angular in the ocular region and evenly curved behind, but nearly straight or even a little concave in the middle, ventral margin very distinctly sinuate, anterior extremity obtusely rounded, posterior rather broader and somewhat deflexed, terminating below in an obtuse corner; seen dorsally, broadly fusiform, with the greatest width about half the length, both extremities abruptly contracted. Surface of shell finely granular and everywhere densely clothed with quite unusually strong curved hairs, giving it a peculiar hirsute appearance; each valve, moreover, exhibiting somewhat behind the centre a single small, but well-marked tubercle, more distinctly visible in the dorsal aspect of the shell. Posterior antennae comparatively slender, with the apical claws of moderate length; natatory setae very small, not even extending to the middle of the penultimate joint. Caudal rami slender and narrow, slightly curved in their outer part; apical claws not very unequal, the larger one scarcely attaining half the length of the ramus.

Male of about same size as female and closely resembling it in the shape of the shell. Prehensile palps of maxillipeds less strong than in the type species and only slightly unequal, thumb-like process very narrow and issuing about in the middle of the hand. Copulatory appendages comparatively large, with the inner lamella narrowly produced at the end, outer lamella broad, leaf-like.

Colour (of preserved specimens) yellowish grey, with irregular dark shadows.

Length of adult female amounting to 5·10 mm.

Remarks.—The above-described form is nearly related to the

two species recorded in the chief account, but evidently specifically distinct from either of them, being especially distinguished by the densely hispid surface of the shell. The shape of the prehensile palps of the maxillipeds in the male, as also that of the copulatory appendages, is, moreover, different, as seen by comparing the figures on the accompanying plate with those given in the chief account.

Occurrence.—Four well-preserved specimens of this form were found in the material received, having been collected by Mr. K. H. Barnard from a pond on the Cape Flats.

30. MEGALOCYPRIS TUBERCULATA, n. sp.

(Plate XX, figs. 23–28.)

Specific Characters.—*Female*.—Shell less elongated than in the preceding species and much more compressed; seen laterally, oblong oval in outline, with the greatest height about half the length, dorsal margin subangular both in front and behind, ventral margin distinctly sinuated, anterior extremity evenly rounded, posterior not deflexed, terminating in an obtuse corner lying about in the longitudinal axis; seen dorsally, narrow oblong, with the greatest width only slightly exceeding $\frac{1}{3}$ of the length, anterior extremity more pointed than the posterior. Valves only sparingly hairy, but each provided with a number of very conspicuous tubercles, one of which, located about in the centre, is particularly strong, umboniform, the others being rather smaller and somewhat irregularly arranged. Posterior antennae comparatively less slender than in the preceding species, and having the natatory setae much more fully developed, extending to about the middle of the apical claws. Caudal rami very narrow and evenly curved; apical claws rather unequal, the larger one about equalling in length half the ramus.

Male scarcely differing from the female in the general shape and armature of the shell. Prehensile palps of maxillipeds with the thumb-like process issuing from near the base of the hand, outer part of the latter very narrow and somewhat curved. Copulatory appendages with the inner lamella obtusely rounded at the end, outer lamella comparatively smaller than in the preceding species and somewhat securiform in shape.

Colour not yet ascertained.

Length of adult female 3.60 mm.

Remarks.—The present form is at once distinguished from any of

the other species of this genus by the peculiar tubercular armature of the shell, a character which indeed has given rise to the specific name here proposed. Moreover, in the structural details some well-marked differences are found, more particularly as regards the development of the natatory setae on the posterior antennae, the shape of the prehensile palps of the maxillipeds in the male, and that of the copulatory appendages.

Occurrence.—Several specimens of this distinct species are in the material received, having been collected by Mr. J. H. Power at Kimberley.

GEN. 11. ISOCYPRIS, G. W. Müller, 1908.

Syn.: *Hyalocypris*, Brady.

Generic Characters.—Shell much compressed, more or less oval in shape, with a rather conspicuous shallow depression just in front of the ocular region. Valves perfectly equal, each exhibiting in front a well-marked transversely striated border partly continued along the ventral face; inner duplicature of the anterior extremity very broad, that of the posterior much smaller, or quite wanting. Surface of shell smooth and more or less densely hairy. Natatory setae of posterior antennae in some cases well developed, in other cases quite rudimentary. Maxillary palp strong, with the terminal joint spatulate in form; masticatory lobes short and thick. Maxillipeds with the masticatory lobe comparatively broad and expanded palp rather small, uniarticulate. Anterior legs of quite an unusual large size, so as not to be wholly withdrawn within the shell, and terminating in an exceedingly slender, almost straight claw. Posterior legs much smaller, and of normal structure. Caudal rami well developed and slightly curved, with the apical claws of moderate size.

Remarks.—This genus was proposed in the year 1908 by G. W. Müller to include two closely allied species *I. perangusta* and *I. priomena*. The characteristic of the genus given by that author appears, however, somewhat unsatisfactory, as no regard has been paid to the most prominent peculiarity of the genus, viz. the extraordinary development of the anterior legs. The relationship to the genus *Amphicypris*, as suggested by Müller, seems to me to be a very remote one. On the other hand, as regards the general shape of the shell and the structure of some of the appendages, a certain resemblance may be found to the genus *Ilyocypris*, which, however, in other respects differs decidedly. The genus *Hyalocypris* of Brady is

evidently identical with Müller's genus. Three well-defined species of the present genus will be described below.

31. *ISOCYPRIS NIVEA*, n. sp.

(Plate IX, figs. 1-13.)

Specific Characters—Female.—Shell, seen laterally, of a somewhat irregular oval reniform shape, with the greatest height somewhat in front of the middle and not fully attaining half the length, dorsal margin perfectly straight in the middle, angularly bent in front, and declining rather steeply behind, preocular sinus well marked, ventral margin slightly concaved, anterior extremity broadly rounded, posterior slightly produced in the middle; seen dorsally, narrow lanceolate in outline, with the greatest width scarcely attaining $\frac{1}{2}$ of the length; anterior extremity more pointed than the posterior. Valves of rather firm consistency and very little pellucid, with the striated marginal rim extending downwards along the whole ventral face and part of the hind extremity, inner duplicature of this extremity distinct, though rather small. Surface of shell of a dull appearance and clothed with comparatively short and delicate hairs, two of them, however, issuing from the posterior extremity of each valve, being much longer than the others. Natatory setae of the posterior antennae quite rudimentary. Caudal rami comparatively narrow, with the outer part of the dorsal edge very finely spinulose.

Male of about same size as female and resembling it in the general shape of the shell. Prehensile palps of maxillipeds quite equal and rather narrow, the proximal joint being scarcely at all expanded, but armed inside beyond the middle with a strong movable spine, distal joint narrow unguiform. Ejaculatory tubes slender, with numerous chitinous whorls. Copulatory appendages with the outer lamella spatulate in form.

Colour of shell uniformly opaque white, most of the appendages of a light yellow hue.

Length of shell amounting to 1.90 mm.

Remarks.—The above-described form is evidently congeneric with the two species recorded by G. W. Müller, but is easily distinguishable from either of them by its much coarser and opaque white shell, and by the rudimentary condition of the natatory setae on the posterior antennae being also of considerably larger size.

Occurrence.—This form was successfully reared in one of my aquaria prepared with mud taken from a pond on Green Point Common.

Some specimens were also found in one of the alcoholic samples sent to me from the South African Museum, and derived from the same region. In accordance with the rudimentary condition of the natatory setae, the animal is quite devoid of swimming power, and the specimens were of course only found on the bottom of the aquarium, more or less deeply buried in the loose mud. Males and females occurred in nearly equal number.

32. *ISOCYPRIS PRIOMENA*, G. W. Müller.

(Plate IX, figs. 14–17, and Plate XIX, figs. 4–7.)

Isocypris priomena, G. W. Müller. L.c. p. 161, figs. 1–5 (in text).

Specific Characters—Female.—Shell comparatively somewhat shorter than in the preceding species and, seen laterally, of a more regular ovoid shape, greatest height behind the middle and about equalling half the length, dorsal margin gently arched and declining quite evenly behind, supraocular angle obsolete, ventral margin slightly sinuated in the middle, anterior extremity somewhat produced and obtusely blunted at the end, preocular sinus well marked; seen dorsally, exhibiting a similar narrow lanceolate shape to that in the preceding species. Valves very thin and pellucid, with the striated marginal border only present in front; inner duplicature of hind extremity quite wanting. Surface of shell smooth and all over clothed with rather coarse recurved hairs, two of which, issuing from the hind extremity, are distinguished by their considerable length. Natatory setae of the posterior antennae well developed, reaching somewhat beyond the apical claws. Caudal rami comparatively broader than in *I. nivea*, with the dorsal edge quite smooth.

Male differing from female in a similar manner to that in the preceding species.

Colour whitish pellucid, with a more or less distinct yellow or pale orange tinge.

Length of shell scarcely exceeding 1.50 mm.

Remarks.—The present form agrees very closely with both of the species recorded by G. W. Müller, and I have indeed been in some doubt to which of them it should more properly be referred. Yet the species named as above seems to be that which, to judge from the figures given, is in the best accordance with the form examined by me.

Occurrence.—This species was reared from the same parcel of mud (Green Point Common) as the preceding one, and it also developed

rather abundantly in another of my aquaria prepared with mud taken at Klipdam, near Kimberley, by Mr. J. H. Power. In contrast to the preceding species, the present form is an habitual swimmer, and the specimens were often seen moving about rather quickly through the water, especially when the aquarium was exposed to the direct sunlight. During these movements the anterior legs were extended straight backwards, projecting with their outer part from the hind end of the shell, as represented in fig. 14. Most of the specimens examined were of the female sex; but I have also succeeded in finding some few male specimens, and have ascertained the accordance of the sexual characters with those in the male of *I. nivea*.

33. ISOCYPRIS PERANGUSTA, G. W. Müller.

(Plate XIX, figs. 1-3.)

Isocypris perangusta, G. W. Müller. Deutsche Südpolar Expedition, Ostracoda, p. 159, figs. 1-7 (in text).

Syn. : *Hyalocypris africana*, Brady.

Specific Characters—*Female*.—Shell much compressed; seen laterally, rather regularly elliptical in outline, greatest height about in the middle and scarcely attaining half the length, dorsal margin slightly depressed in the ocular region, but otherwise quite evenly arched, without any trace of an angle behind, ventral margin slightly sinuated in the middle, anterior extremity broadly rounded, posterior somewhat narrower and evenly obtuse; seen dorsally, lanceolate in shape, with the greatest width scarcely exceeding $\frac{1}{4}$ of the length. Valves thin and pellucid, perfectly equal, and clothed with scattered rather strong curved hairs, two of which, issuing from the hind extremity, are particularly elongated; anterior duplicature very broad, posterior wholly absent; marginal zone simple, without any chitinous stripes. Natatory setae of posterior antennae well developed, extending to the tips of the apical claws. Caudal rami slightly curved and nearly of equal width throughout; apical claws subequal and about half the length of the ramus; dorsal seta comparatively small.

Colour not yet ascertained.

Length of adult female 1.10 mm.

Remarks.—This is unquestionably the species recorded by G. W. Müller under the above name, agreeing perfectly with the description and figures given by that author. It is closely allied to *I. priomena* of the same author, but of much smaller size, and has the shell con-

spicuously narrower, with the marginal cone quite simple. The form recorded by Brady under the name *Hyalocypris africana* seems to be identical with the present species.

Occurrence.—Two female specimens of this form were found in the material collected by Mr. K. H. Barnard from a pond on the Cape Flats.

GEN. 12. ILYOCYPRIS, Brady and Norman.

Remarks.—This genus in some particulars differs rather essentially from the other Cypridae, and has indeed by recent authors been regarded as the type of a distinct subfamily, *Ilyocyprinae*. It comprises a rather great number of species from different parts of the world; but some of these are so closely related that their distinction is connected with no small difficulty. One of these species is represented in the Fauna of the Cape Province, and will be briefly described below.

34. ILYOCYPRIS AUSTRALIENSIS, G. O. Sars.

(Plate IX, figs. 18–25.)

Ilyocypris australiensis, G. O. Sars. On some Fresh-water Ostracoda and Copepoda raised from dried Australian mud. Chr. Ved. Selsk. Fork. 1889, No. 6, p. 46, pl. ii, figs. 5–8, pl. vi.

Specific Characters—*Female*.—Shell, seen laterally, oblong quadrangular in outline, with the greatest height quite in front and somewhat exceeding half the length, dorsal margin nearly straight and forming above the ocular region a well-marked projecting angle, ventral margin conspicuously sinuated in the middle, anterior extremity broadly rounded, posterior almost transversely truncated; seen dorsally, narrow oblong and slightly constricted in the middle, but without any traces of later protuberances, greatest width somewhat exceeding $\frac{2}{3}$ of the length and occurring behind the middle. Valves rather opaque and nearly equal, with a well-marked transverse depression near the dorsal face; inner duplicatures not particularly broad. Surface of shell sculptured with rather closely set angular pits, giving it a dull appearance, anterior and posterior edges finely hairy and moreover armed with very small and closely set spinules. Structure of the several appendages resembling that in the type species (*I. gibba*), the natatory setae of the posterior antennae being well developed.

Colour whitish grey.

Length of shell amounting to 0.82 mm.

Remarks.—This species was described in the year 1889 by the present author from specimens raised from Australian mud. It is nearly allied to the European species *I. gibba* (Ramdohr), but easily distinguished from it by the absolute absence of the horn-like lateral protuberances on the shell characteristic of that species.

Occurrence.—Some few female specimens of this form were found in one of my aquaria prepared with mud from the neighbourhood of Bergvliet.

GEN. 13. CYPRIA, Zencker, 1854.

Remarks.—This genus was established as early as the year 1854 by Zencker to include the European species *C. ophthalmica* (Jurine), and has been admitted by all subsequent authors. It is indeed a very distinct one, exhibiting some well-marked peculiarities of both sexes. In addition to the type species, some other congeneric forms have been recorded in recent time, one of which is represented in the Fauna of the Cape Province.

35. CYPRIA CAPENSIS, G. O. Sars.

(Plate X, figs. 1–15.)

Cypria capensis, G. O. Sars. On some South African Entomostraca raised from dried mud. Chr. Vid. Selsk. Skrifter, 1895, p. 28, pl. v, fig. 1, a–b.

Syn. : *Cypria armata*, G. W. Müller.

Specific Characters—Female.—Shell much compressed; seen laterally, broadly oval in outline, greatest height behind the middle and about equalling $\frac{3}{5}$ of the length, dorsal margin as a rule evenly arched, only in some cases exhibiting a slight indication to an angle in front and behind, ventral margin slightly concave in the middle, anterior extremity obliquely rounded, posterior rather broad and obtusely blunted, being somewhat expanded below; seen dorsally, narrow oblong, and tapered in front, anterior extremity more pointed than the posterior. Valves conspicuously unequal, the left one overlapping the right in front by a rather broad hyaline border, as also somewhat below; right valve generally (but not always) armed along the anterior edge and part of the inferior with minute closely set tubercles. Surface of shell smooth and polished, though exhibiting, when seen under a high magnifying power, a very delicate longitudinal striation, only very slight traces of hairs being observable. Structure of the several appendages closely resembling that in the type species.

Male rather smaller than female and having the shell somewhat less high. Prehensile palps of maxillipeds rather unequal, the right one being much the larger, with the proximal joint somewhat widening distally and produced at the end inside to a digitiform process, distal joint claw-like and considerably stronger than that of the right, with a distinct dentiform prominence at the base. Ejaculatory tubes rather large and easily observable through the pellucid shell, each only provided with seven very strongly marked chitinous whorls, proximal end bladder-like produced. Copulatory appendages comparatively small, with both lamella drawn out at the end to narrow pointed lappets.

Colour in female light yellowish or orange, with a more or less distinct rosy or purplish tinge, and variegated with irregular patches and dots of a darker hue; that in male rather paler.

Length of shell amounting to 0.75 mm.

Remarks.—This species was described, though somewhat imperfectly, by the present author in the year 1895, from specimens raised out of mud from the Knysna swamp. The form recorded by G. W. Müller from the equatorial part of Africa under the name of *C. armata* is undoubtedly the same species.

Occurrence.—Numerous specimens of this beautiful little Ostracod developed in one of my aquaria prepared with mud taken from pools on Green Point Common. It was also present in some of the parcels of mud taken by Mr. Orjan Olsen in the neighbourhood of the whaling station at Saldanha Bay; but, curiously enough, no living specimens were obtained from this mud, though other Ostracods developed from it in great abundance.

GEN. 14. BRADYCYPRIS, n.

Generic Characters.—Shell very tumid and of a short and bulky shape, with the valves conspicuously unequal, the left one being much the larger, right valve provided in front with a well-marked coarsely striated marginal zone. Surface of shell smooth. Natatory setae of the posterior antennae well developed. Maxillary palp slender, with the terminal joint narrow cylindrical in form; masticatory lobes attenuated. Maxillipeds and legs of usual structure. Caudal rami very slender and narrow.

Remarks.—This new genus is established to include a peculiar Ostracod recorded by Brady and referred by him to the genus *Cypris*. A closer examination of this Ostracod has, however, proved it to

differ so considerably in the structure of the shell, both from *Cypris* and most other genera, that it, in my opinion, ought more properly to be regarded as the type of a distinct genus. The generic name here proposed alludes to the bulky shape of the shell.*

36. BRADYCYPRIS INTUMESCENS (Brady).

(Plate X, figs. 16-27.)

Cypris intumescens, Brady. Ann. Natal Gov. Museum, vol. i, pt. 2, p. 173, pl. xxix, figs. 1-5.

Specific Characters—Female.—Shell, seen laterally, rounded oval or somewhat trigonal in outline, with the greatest height quite in front and exceeding $\frac{3}{5}$ of the length, dorsal margin boldly arched, forming in front of the middle an almost hump-shaped curvature, whence it declines rather steeply both in front and behind, ventral margin slightly sinuated in the middle, anterior extremity obliquely rounded, posterior obtusely blunted; seen dorsally, broadly ovoid in shape, with the greatest width about equalling $\frac{3}{5}$ of the length and occurring behind the middle, anterior extremity beak-like produced, posterior obtuse. Valves very unequal, the left one overlapping the right considerably along the anterior extremity, striated marginal area of right valve very conspicuous. Surface of shell smooth, without any more conspicuous sculpturing and clothed on both extremities with delicate hairs. Natatory setae on the posterior antennae reaching nearly to the tips of the apical claws. Caudal rami exceedingly slender and narrow, with the apical claws rather elongate, dorsal and apical setae very small.

Male resembling the female in the general shape of the shell, but of rather smaller size. Prehensile palps of maxillipeds somewhat unequal, the terminal joint of the right one being much broader than that of the left one and somewhat boot-shaped. Ejaculatory tubes comparatively large, with numerous chitinous whorls and the proximal end slightly produced. Copulatory appendages with the outer lamella drawn out to a somewhat twisted lappet.

Colour pale yellow, the ripe ova shining through the shell with a bright orange hue.

Length of shell amounting to 1.50 mm.

Remarks.—This species, the only one as yet known of the present genus, was described by Brady from a solitary female specimen

* The form recorded by G. W. Müller as *Cypris radiata* is perhaps referable to the present genus.

obtained at Somkele, Zululand. It may easily be recognised from any of the hitherto known *Cypridae* by the shape and peculiar structure of the shell.

Occurrence.—Numerous specimens of this Ostracod developed in some of my aquaria prepared with mud taken by Dr. Purcell from old gravel-pits on the Bergvliet Flats. It also occurred in some of the alcoholic samples sent to me from the South African Museum, and in that taken by Dr. Purcell at Ashton. Almost all the specimens examined by me were of the female sex, only one or two males having as yet come under my notice.

GEN. 15. CYPRETTA, Vávra, 1895.

Remarks.—This genus was proposed in the year 1895 by Vávra to include a small Cyprid (*C. tenuicauda*) found at Zanzibar, but was by that author merely regarded as a subgenus of *Cypridopsis*. In recent times, however, several additional species have been detected agreeing perfectly with that originally described, as also with each other, in all essential characters, thus proving this genus to be in reality a very well-defined one. It is chiefly distinguished from *Cypridopsis* by the structure of the caudal rami, which, on the whole, is quite normal; whereas in *Cypridopsis* these rami are reduced to trifling rudiments. Another character by which the present genus is at once recognised is found in the very conspicuous radiating septa dividing the marginal zone of both valves in front.

Three species belonging to this genus will be described below, as represented in the Fauna of the Cape Province.

37. CYPRETTA TURGIDA, G. O. Sars.

(Plate X, figs. 28–33.)

Cypridopsis turgida, G. O. Sars. Fresh-water Entomostraca from the neighbourhood of Sydney. Arch. f. Mathem. u. Naturv. f. 1896, p. 62.

Specific Characters—*Female*.—Shell exceedingly tumid, the width even somewhat exceeding the height; seen laterally, almost semi-circular in outline, greatest height in the middle and about equalling $\frac{2}{3}$ of the length, dorsal margin boldly arched and declining quite evenly both in front and behind, ventral margin scarcely at all sinuated, both extremities rounded off, the anterior somewhat broader than the posterior; seen dorsally, broadly cordate, slightly narrowed

in front, obtusely rounded behind. Valves nearly equal, both exhibiting anteriorly a rather sharply-defined marginal area crossed by a number of very conspicuous dark-coloured septa; inner duplicatures not very broad. Surface of shell smooth and rather densely hairy. Posterior antennae with the apical claws very slender and elongated; natatory setae well developed, reaching to the tips of the claws. Caudal rami rather small and narrow linear in form; terminal claws very thin and rather unequal in length; apical bristle apparently wanting.

Colour light olivaceous changing to yellowish brown, with indistinctly-marked darker shadows.

Length of shell amounting to 0.90 mm.

Remarks.—This form was originally (in the year 1894) described and figured by the present author, but was at that time erroneously identified with *Cypris minna* of King. Having, however, subsequently had an opportunity of examining the true *minna* of King, I proposed (in 1896) for the present form the above specific name. It is easily distinguished from the two other species here described by its very tumid shell and the rather uniform colour.

Occurrence.—The present form developed rather abundantly in some of my aquaria prepared with mud taken by Dr. Purcell from a vley on the Cape Flats. All the specimens examined were of the female sex, no males having ever been detected either of this or of any of the other species of the present genus.

Distribution.—New Zealand, Australia, Madagascar, China.

38. CYPRETTA MINNA (King).

(Plate XI, figs. 1 and 2.)

Cypris minna, King. On Australian Entomostraca. Papers and Proc. Roy. Soc. Van Diemen's Land, vol. iii, pt. 1, p. 64, pl. x b.

Syn. : *Cypretta costata*, G. W. Müller.

Specific Characters—*Female*.—Shell rather tumid; seen laterally, very broad, of a rounded trigonal shape, the greatest height almost attaining the length, dorsal margin strongly arched, forming in the middle an abrupt, almost hump-shaped bend, and declining rather steeply both in front and behind, ventral margin very slightly sinuated in the middle, both extremities rounded off, the anterior somewhat broader than the posterior; seen dorsally, rounded oval, with the greatest width behind the middle. Valves a little unequal, the right one overlapping the left somewhat in the middle of the dorsal

face, as also anteriorly; marginal area of the anterior extremity well defined and having the radial septa rather conspicuous.

Colour light yellowish and variegated with irregular, partly anastomosing patches of a dark green hue.

Length of shell amounting to 0.90 mm.

Remarks.—This form was described as early as in the year 1855 by King from Australian specimens, and was subsequently also recorded by Brady. It is easily recognised by its exceedingly high, almost trigonal shell, as also by its rather characteristic colour. The form recorded by G. W. Müller under the name of *C. costata* is unquestionably the same species.

Occurrence.—Several specimens of this form developed in one of my aquaria prepared with mud taken by Dr. Purcell in the neighbourhood of Bergvliet.

Distribution.—Australia (King); Madagascar (G. W. Müller).

39. CYPRETTA GLOBULUS, G. O. Sars.

(Plate XI, figs. 3 and 4.)

Cypridopsis globulus, G. O. Sars. On some Fresh-water Ostracoda and Copepoda raised from dried Australian mud. Chr. Ved. Selsk Forh. 1889, p. 53, pl. ii, figs. 9 and 10, pl. vii, figs. 1–11.

Specific Characters—Female.—Shell, seen laterally, rounded subtriangular in outline, greatest height somewhat exceeding $\frac{2}{3}$ of the length, dorsal margin boldly arched and abruptly bent in the middle, ventral margin very slightly sinuated, both extremities obliquely rounded; seen dorsally, very broad, with the greatest width behind the middle and somewhat exceeding the height. Valves nearly equal, marginal area of the anterior extremity well defined and crossed by the usual septa. Surface of shell finely granular and clothed with delicate hairs.

Colour light yellowish, with three rather conspicuous, irregularly flexuous bands of a dark green hue extending down the sides of the valves.

Length of shell scarcely exceeding 0.70 mm.

Remarks.—This form was described in the year 1889 by the present author as a species of the genus *Cypridopsis*. It is, however, evidently referable to the present genus, agreeing perfectly in all essential characters with the two preceding species, though being specifically distinct from both of them.

Occurrence.—This form only developed in one of my aquaria

prepared with mud from the pond at Bergvliet. Several specimens were however secured, all of them being, as usual, of the female sex.

Distribution.—Australia (the present author).

GEN. 16. ZONOCYPRIS, G. W. Müller, 1898.

Remarks.—This genus was proposed in the year 1898 by G. W. Müller to comprise three species, one of which had previously been recorded by Vávra, but referred by him to the genus *Cypridopsis*. It agrees with the latter genus in the rudimentary condition of the caudal rami, but differs decidedly in the coarse sculpture of the shell, as also in the structure of the posterior antennae. Two somewhat anomalous species, apparently referable to this genus, will be described in the sequel.

40. ZONOCYPRIS CORDATA, n. sp.

(Plate XI, figs. 5–15.)

Specific Characters—Female.—Shell very tumid; seen laterally, rounded trigonal in outline, with the greatest height about in the middle and nearly attaining $\frac{2}{3}$ of the length, dorsal margin boldly arched, ventral only very slightly sinuated, anterior extremity obliquely rounded, posterior obtusely blunted; seen dorsally, broadly cordiform, with the greatest width far behind and exceeding the height, anterior extremity gradually contracted, posterior broadly rounded off. Valves slightly unequal, the left one overlapping the right somewhat along the anterior extremity, right valve armed, a little within the edge, both in front and behind with a row of minute tubercles; inner duplicatures somewhat broader in front than behind. Surface of shell coarsely sculptured with numerous closely set knob-like tubercles arranged more or less distinctly in concentric rows, and clothed in front and behind with comparatively short and delicate hairs. Anterior antennae, mandibles, maxillipeds, and legs of normal structure. Posterior antennae, however, distinguished by their unusually coarse and compact appearance, penultimate joint very short; apical claws rather unequal, two of them issuing from the penultimate joint remarkably strong and cultriform, the inner one distinctly serrate behind; natatory setae well developed, reaching beyond the apical claws. Maxillary palp with the terminal joint narrow cylindric in form. Caudal rami imperfectly developed, being replaced by two small narrowly produced lappets, each terminating in a thin seta.

Colour dark olivaceous green, more generally with a chestnut brown tinge along the anterior and posterior edges of the shell.

Length of shell amounting to 0.56 mm.

Remarks.—The above-described form is easily distinguished from any of the other known species of the present genus, both as to the general shape of the shell and to its sculpture, though agreeing pretty well with them in the structure of the several appendages and more particularly in the characteristic appearance of the posterior antennae.

Occurrence.—This form was found in several of my aquaria prepared with mud from different places in the neighbourhood of Cape Town. It did not, however, occur in any considerable number, and was only occasionally taken up by the dipping-tube, its comparatively small size also rendered it rather difficult to detect it. All the specimens examined were of the female sex.

41. *ZONOCYPRIS TUBEROSA*, G. W. Müller.

(Plate XI, figs. 16–25.)

Zonocypris tuberosa, G. W. Müller. L.c. p. 167, figs. 1–5 (in text), pl. xix, figs. 1, 5.

Specific Characters—*Female*.—Shell far less tumid than in the preceding species; seen laterally, of a rather regular oval reniform shape, with the greatest height somewhat in front of the middle and only slightly exceeding half the length, dorsal margin quite evenly arched throughout, ventral distinctly sinuated, anterior extremity evenly rounded, posterior obtusely blunted; seen dorsally, ovoid in shape, with the greatest width behind and slightly exceeding the height, anterior extremity gradually narrowed, posterior broadly rounded. Valves nearly equal and rather pellucid, with the inner duplicatures comparatively small. Surface of shell densely reticulated and clothed all over with unusually strong, almost spiniform hairs curving as a rule backwards and attached to prominent knob-like tubercles, with which they seem to be movably articulated. Structure of the several appendages on the whole closely agreeing with that in the preceding species.

Male of nearly same size as female and resembling it in the general appearance of the shell. Posterior antennae with the apical claws less strongly developed, those issuing from the penultimate joint being scarcely larger than that of the last joint. Prehensile palps of maxillipeds slightly unequal, the claw-like distal joint being rather

broadier on the right than on the left palp, proximal joint in both of them somewhat dilated distally and exerted at the end inside to a triangular lappet. Ejaculatory tubes with about sixteen chitinous whorls, proximal ends slightly funnel-shaped. Copulatory appendages with the outer lamella unequally bilobular at the end, outer lobe broadly rounded, inner narrowly exerted.

Colour bright green, somewhat paler in front.

Length of shell amounting to 0.75 mm.

Remarks.—I cannot doubt that the above-described form is identical with that recorded by G. W. Müller, though the hairs of the shell, as represented in the figures given by that author on Plate XIX, appear far less strongly developed than in the specimens examined by me. The outward appearance of the present form looks so very different from that of the preceding species, that it hardly should be assumed that they were congeneric. Yet, on a closer examination, the several appendages are found to be built on the very same type, and I thus fully agree with Müller in referring this form to the genus *Zonocypris*, though the generic name appears less significant of the present species.

Occurrence.—Only a few specimens of this peculiar form have as yet come under my notice. They were found in one of my aquaria prepared with mud taken by Dr. Purcell from old gravel-pits on the Bergvliet estate. Two of the specimens secured proved to be of the male sex. G. W. Müller obtained this form from Plumstead.

GEN. 17. PARACYPRETTA, n.

Generic Characters.—Shell short and tumid, resembling somewhat in shape that in *Cypretta*. Valves however very unequal, the left one projecting far beyond the right at the anterior extremity, right valve exhibiting, somewhat inside the anterior edge, a narrow marginal area crossed by a number of short and thick, strongly chitinated septa. Surface of shell sculptured with closely set longitudinal ridges and rather densely hairy. Posterior antennae comparatively slender, with the penultimate joint rather produced and the apical claws long and narrow; natatory setae well developed. Maxillary palp slender, with the terminal joint cylindric in form. Maxillipeds with the branchial plate imperfectly developed. Caudal rami very narrow, styliform, though armed at the end in the usual manner. Propagation exclusively parthenogenetical.

Remarks.—This new genus is established to comprise three well-

defined species which in all essential characters agree with each other, thus forming together a quite natural group. As indicated by the generic name here proposed, it seems to come nearest to *Cypretta*, differing, however, decidedly in the structure of the shell. The form recorded by G. W. Müller under the name of *Cypris syngramma* may perhaps be adduced to this genus.

42. PARACYPRETTA AMPULLACEA, n. sp.

(Plate XII, figs. 1-13.)

Specific Characters.—Shell exceedingly broad and expanded, sub-depressed, with the ventral face flattened; seen laterally, almost semilunar in outline, greatest height about in the middle and slightly exceeding $\frac{2}{3}$ of the length, dorsal margin boldly arched, ventral distinctly sinuated, anterior extremity conspicuously deflexed, forming below a projecting, almost angular expansion, posterior extremity obtusely blunted; seen dorsally, broadly rounded, with the greatest width almost equal to the length and considerably exceeding the height, anterior extremity slightly produced and somewhat twisted to the right side. Valves conspicuously unequal, the right one being almost transversely truncated anteriorly and overlapped here by a semilunar projecting lappet of the left one. Surface of shell sculptured with closely set longitudinal striae partly anastomosing in front and behind, and all over clothed with comparatively short and delicate hairs.

Colour dark olivaceous, with a more or less distinct greenish tinge.

Length of shell about 1 mm.

Remarks.—This species may be regarded as the type of the present genus. It is easily distinguished from the other two species here recorded by the exceedingly broad and expanded shell, a character which indeed has given rise to the specific name proposed. On the accompanying plate, figures of the several appendages in the present species have been given for comparison with those of the other genera here treated of.

Occurrence.—Numerous specimens of this form were contained in one of the alcoholic samples sent to me from the South African Museum, and taken from a vley on Green Point Common. I have also had an opportunity of examining this form in the living state, some four specimens being raised from dried mud derived from about the same locality.

43. PARACYPRETTE RUBRA, n. sp.

(Plate XII, figs. 14 and 15.)

Specific Characters.—Shell far less expanded than in the preceding species; seen laterally, of a comparatively short rounded oval shape, with the greatest height somewhat in front of the middle and considerably exceeding $\frac{3}{5}$ of the length, dorsal margin boldly arched, ventral only slightly sinuated, anterior extremity scarcely expanded below and broader than the posterior; seen dorsally, rounded oval in form, with the greatest width about equalling $\frac{3}{4}$ of the length, both extremities slightly narrowed. Valves exhibiting a similar very conspicuous unequalness in front to those in the preceding species. Surface of shell with the longitudinal ridges very sharply marked and rather more distant than in that species, the hair clothing the shell moreover considerably coarser, some of them attaining a very great length.

Colour rather unusual, the shell exhibiting throughout a bright reddish hue.

Length of shell amounting to 0.90 mm.

Remarks.—This form, when examined in the living state, may at once be recognised by its quite unusual colour. It also exhibits some well-marked differences from the other two species in the shape and sculpture of the shell, as indicated in the above diagnosis.

Occurrence.—Only some few specimens of this form have as yet come under my notice. They were found in one of my aquaria prepared with mud from a shallow vley on the Bergvliet Flats, and at once attracted my attention by their bright red colour.

44. PARACYPRETTE ACANTHIFERA, n. sp.

(Plate XII, figs. 16, 17.)

Specific Characters.—Shell rather tumid; seen laterally, of a somewhat similar short oval shape to that in *P. rubra*, greatest height in front of the middle, dorsal margin rather evenly arched and declining somewhat more steeply in front than behind, ventral margin nearly straight, anterior extremity conspicuously deflexed, forming below a somewhat projecting expansion, posterior extremity evenly rounded; seen dorsally, broadly ovate, with the greatest width in the middle and slightly exceeding $\frac{3}{4}$ of the length, anterior extremity somewhat produced and twisted to the right side. Valves, as in the two preceding species, of a very unequal appearance in their anterior part. Surface

of shell with the longitudinal ridges rather densely crowded, being, moreover, armed in the posterior part with scattered sharply pointed spines intermingled with the usual hairs, some of the latter, as in *P. rubra*, rather coarse and elongated.

Colour dark olivaceous green.

Length of shell amounting to 1·10 mm.

Remarks.—The present species may be easily recognised from the two preceding ones by the spinous armature of the shell, this character having indeed given rise to the specific name here proposed. It is also of rather larger size than either of them.

Occurrence.—A considerable number of specimens of this form have been obtained, most of them being reared in my aquaria from mud taken in the neighbourhood of Cape Town. All the specimens examined both of this and the two preceding species were of the female sex, and the parthenogenetical nature of them thus ascertained.

GEN. 18. PIONOCYPRIS, Brady and Norman, 1896.

Remarks.—The type of this genus, proposed by Brady and Norman in 1896, is the well-known European species *Cypris vidua* O. Fr. Müller, which more generally has been included in the genus *Cypridopsis*. Though the genus has not been admitted by recent authors, I think that it ought to be supported, as there are several forms which closely agree with the above-named type species and together with it apparently form a well-defined group. The differences from *Cypridopsis* (proper) are chiefly found in the shape of the shell, and more particularly in the mutual relation of the valves, as also in the colour, the shell being in most cases banded transversely with a dark pigment, as in some species of the genus *Cypretta*.

Three species, referable to the present genus, will be described below, as belonging to the Fauna of the Cape Province.

45. PIONOCYPRIS ASSIMILIS (G. O. Sars).

(Plate XIII, figs. 1–10.)

Cypridopsis assimilis, G. O. Sars. On some South African Entomostraca raised from dried mud. Chr. Vid. Selsk. Skriften, 1895, p. 42, pl. vi, fig. 3, a–b.

Specific Characters.—Shell rather tumid; seen laterally, oblong oval in outline, greatest height in the middle and about equalling $\frac{3}{5}$ of the length, dorsal margin evenly arched and declining somewhat

more steeply in front than behind, ventral margin slightly sinuated in the middle, anterior extremity obliquely rounded, posterior obtuse; seen dorsally, subovate, greatest width behind the middle and somewhat exceeding $\frac{2}{3}$ of the length, anterior extremity more pointed than the posterior. Valves slightly unequal, the right one being somewhat overlapped in front by the left, and, moreover, armed along the anterior edge with a row of very small tubercles wanting on the left valve; inner duplicatures considerably broader in front than behind. Surface of shell smooth and rather densely clothed with delicate hairs. Natatory setae of posterior antennae reaching to the tips of the apical claws. Maxillae with both the palp and the masticatory lobes narrowly produced. Maxillipeds with the branchial plate replaced by four or five short setae. Caudal rami very small and rudimentary, each drawn out to a slender bristle.

Colour whitish or pale yellow and variegated with three or four irregular band-like patches of a very dark hue extending across the shell.

Length of shell about 0.70 mm.

Remarks.—This form was briefly described by the present author in the year 1895 from specimens raised out of mud from the Knysna swamp, and was at that time referred to the genus *Cypridopsis*. It is nearly allied to the type species, but of somewhat larger size, and differing slightly in the shape of the shell.

Occurrence.—Specimens of this form were obtained, besides from the Knysna swamp, also from the vley at Port Elizabeth and from pools near the whaling station at Saldanha Bay.

46. *PIONOCYPRIS INTERMEDIA*, n. sp.

(Plate XIII, figs. 11 and 12.)

Specific Characters.—Shell very tumid; seen laterally, of a somewhat trigonal shape, the dorsal margin being very strongly, almost hump-like arched in the middle, ventral margin nearly straight, both extremities obliquely rounded; seen dorsally, broadly oval, with the greatest width about in the middle and fully equalling $\frac{3}{4}$ of the length, both extremities obtusely pointed. Mutual relation of the valves and structure of the several appendages much as in the preceding species.

Colour whitish, with the transverse dark bands very conspicuous and arranged in a similar manner to that in *P. assimilis*.

Length of shell about 0.60 mm.

Remarks.—This form is perhaps still more closely allied to the type species than the preceding one, though scarcely identical with it, differing, as it does, rather conspicuously in the much more strongly arched dorsal face of the shell, as also somewhat in colour.

Occurrence.—Some few specimens of this form were found in one of my aquaria prepared with mud taken from pools on the Bergvliet Flats.

47. *PRIONOCYPRIS VIDUELLA* (G. O. Sars).

(Plate XIII, figs. 13 and 14.)

Cypridopsis viduella, G. O. Sars. L.c. p. 41, pl. vi, fig. 2, *a-b*.

Specific Characters.—Shell far less tumid than in the two preceding species; seen laterally, broadly oval in outline, greatest height about in the middle and equalling $\frac{3}{5}$ of the length, dorsal margin rather evenly arched, ventral nearly straight, both extremities obtusely rounded; seen dorsally, oblong oval, with the greatest width in the middle and not exceeding the height. Structure of shell and appendages as in the two preceding species.

Colour whitish, variegated with dark bluish-green patches and dots not clearly arranged in transverse bands.

Length of shell amounting to 0.63 mm.

Remarks.—This form was briefly described by the present author at the same time as *P. assimilis*. It may easily be distinguished from the two preceding species, as also from the typical form, by the far less tumid shell and by its rather different colouring.

Occurrence.—The specimens originally examined were raised out of mud taken from the Knysna swamp, and I have not obtained this form from any other locality. It has, however, been recorded by Daday (1913) from Steinkopf and Kamaggas in Little Namaqualand, and two localities in South-West Africa. All the specimens examined by me, both of this and the other two species, were of the female sex.

GEN. 19. *CYPRIDOPSIS*, Brady, 1866.

Remarks.—This genus was established as early as the year 1866 by Brady, and was originally intended to comprise all the Cyprids with rudimentary lash-shaped caudal rami, three species being at first recorded by that author. Subsequently many additional forms with similar rudimentary caudal rami were detected, and of these some were retained in the genus *Cypridopsis*, whereas others were separated as types of nearly allied genera. Of such genera two have been

treated of in the preceding pages, viz. *Zonocypris* and *Pionocypris*; and a third genus, *Cyprilla*, will be mentioned farther on. Of the three species originally referred by Brady to *Cypridopsis*, only one, viz. *C. aculeata*, still is left in that genus, the other two being generally separated and referred, the one to the genus *Potamocypris*, the other to *Pionocypris*. Yet, even in the restriction thus established the present genus comprises a great number of species distributed in different parts of the world, and especially on the African continent this genus has turned out to be very abundantly represented. In my account of the Ostracoda of the Third Tanganyika Expedition,* I have recorded no less than ten species referable to this genus from the great Central African lakes, and a still greater number of additional species will be described in the present treatise as belonging to the Fauna of the Cape Province.

48. CYPRIDOPSIS GREGARIA (G. O. Sars).

(Plate XIII, figs. 15-27.)

Potamocypris gregaria, G. O. Sars. L.c. p. 43, pl. v, fig. 4, a-c.

Syn.: *Cypridopsis triquetra*, G. W. Müller.

Specific Characters—*Female*.—Shell somewhat compressed; seen laterally, of a rounded subtriangular shape, greatest height in the middle and about equalling $\frac{2}{3}$ of the length, dorsal margin boldly arched, forming in the middle an almost angular bend and declining somewhat more steeply in front than behind, ventral margin slightly sinuated in the middle, anterior extremity obliquely rounded, posterior obtusely blunted; seen dorsally, oblong ovate, more pointed in front than behind, greatest width about half the length. Valves only slightly unequal, the right one, however, as in the other species of the present genus, somewhat overlapping the left along the anterior extremity, edges of both valves smooth, inner duplicatures comparatively narrow. Surface of shell sculptured with closely set pits and rather densely hairy, but without any traces of spines. Natatory setae of posterior antennae very fully developed, reaching considerably beyond the apical claws. Maxillary palp with the terminal joint narrow cylindric in form, masticatory lobes moderately produced. Maxillipeds with the branchial plate imperfectly developed and only replaced by two short setae. Caudal rami very small, lash-shaped, being drawn out at the end to a slender bristle.

Male of somewhat smaller size than female, and having the shell

* Proc. Zool. Soc. London, 1910, p. 732.

comparatively less high. Spermatie tubes forming dense coils both in the anterior and posterior parts of the valves. Copulatory appendages with a rounded expansion outside, outer lamella rather projecting and terminating in a hook-like incurved point.

Colour dark brownish green.

Length of shell in female amounting to 0.80 mm.

Remarks.—This form was described in the year 1895 by the present author, but was at that time erroneously referred to the genus *Potamocypis*. It is, however, a true member of the present genus and closely allied to the type species *C. aculeata*, yet differing from it conspicuously in the absolute absence of any spines or denticles on the shell. The form recorded by G. W. Müller under the name of *C. triquetra* is scarcely different from the present species.

Occurrence.—The specimens originally examined were derived from the Knysna swamp. I have subsequently reared this form in great abundance from a parcel of mud taken in the neighbourhood of Bergvliet, as also from mud taken by Mr. Orjan Olsen near the whaling station at Saldanha Bay. In some cases this form seems to propagate in an exclusively parthenogenetic manner, in other cases, however, male specimens are by no means seldom to be found, and I have often witnessed the copulation of the two sexes. In habits it agrees with the other species of this genus, being a rather active swimmer.

49. CYPRIDOPSIS SPINIFERA, n. sp.

(Plate XIV, figs. 1 and 2.)

Specific Characters—Female.—Shell, seen laterally, rounded triangular in outline, with the greatest height in the middle and somewhat exceeding $\frac{3}{5}$ of the length, dorsal margin boldly arched, almost angular in the middle, ventral margin slightly sinuated, anterior extremity evenly rounded at the end, posterior blunted; seen dorsally, oblong ovate, more pointed in front than behind. Valves nearly equal, and exhibiting the granular sculpture very distinctly. Surface of shell armed, in addition to the usual delicate hairs, with a number of sharply pointed spines, some of which, particularly on the posterior part of the shell, are very slender and recurved, a regular row of similar, though somewhat shorter spines being present outside the anterior edge of each valve.

Colour more or less dark green.

Length of shell amounting to 0.80 mm.

Remarks.—This species is nearly allied to the preceding one, and

still more perhaps to the type species *C. aculeata*, the shell being, as in the latter form, armed with very conspicuous spines in addition to the hairs. The spines are, however, in the present species much more produced and also less densely crowded.

Occurrence.—Numerous specimens of this form were contained in some of the alcoholic samples sent to me from the South African Museum, collected on the Cape Flats by Mr. K. H. Barnard; and I have also succeeded in rearing it rather abundantly in several of my aquaria prepared with mud from different localities in the neighbourhood of Cape Town. Most of the specimens examined were of the female sex.

50. CYPRIDOPSIS ACULEATA (Costa).

(Plate XIV, figs. 3 and 4.)

Cypris aculeata, Costa. Fauna del regni di Napoli, p. 11, pl. iii, fig. 5.

Specific Characters—Female.—Shell, seen laterally, exhibiting a somewhat similar short triangular shape to that in the two preceding species, the dorsal margin being boldly arched and subangular in the middle, though declining somewhat more steeply behind, without any more obvious curvature at the junction with the hind edges, ventral margin nearly straight, anterior extremity obliquely rounded, posterior evenly obtuse below; seen dorsally, subovate in shape, with the greatest width behind the middle and about half the length. Surface of shell distinctly granular and armed, in addition to the hairs, with numerous comparatively short tooth-like spines very densely crowded on the dorsal and lateral faces, but less conspicuous in front, no regular row of marginal spines being observable.

Colour as a rule dark green, in some instances with a brownish tinge.

Length of shell amounting to 0.65 mm.

Remarks.—I am unable to distinguish the above-described form from the well-known European species, though the specimens examined by me were of somewhat larger size and differed a little in colour. The species was recorded as early as the year 1846 by Costa, and was subsequently described as new by Lilljeborg, though with the very same specific name. It is closely allied to the preceding species, differing, however, conspicuously in the much shorter and stouter spines, as also a little in the shape of the shell.

Occurrence.—Only a few female specimens of this form have been secured. They were found, together with *C. gregaria*, in

one of my aquaria prepared with mud from a small pool on the Cape Flats.

Distribution.—Throughout Europe, Iceland, Central Asia, and North Africa.

51. CYPRIDOPSIS ELIZABETHAE, n. sp.

(Plate XIV, figs. 5 and 6.)

Specific Characters—Female.—Shell more elongated than in the three preceding species; seen laterally, of a somewhat irregular oval reniform shape, with the greatest height about in the middle and scarcely exceeding $\frac{3}{5}$ of the length, dorsal margin rather evenly arched and declining more steeply in front than behind, ventral margin distinctly sinuated, anterior extremity obliquely rounded, posterior somewhat deflexed; seen dorsally, oblong ovate in form, with the greatest width behind the middle and not attaining half the length. Surface of shell nearly smooth, without any traces of spines, but rather densely clothed with delicate hairs.

Colour light yellowish green, clouded dorsally with irregular patches of a darker hue.

Length of shell amounting to 0.70 mm.

Remarks.—The present species agrees with *C. gregaria* in the absence of any spines on the shell, but differs both from this and the other two species described above by the less high and more reniform shape of the shell, as also by its much paler colour.

Occurrence.—This form was reared rather abundantly in some of my aquaria prepared with mud from the neighbourhood of Port Elizabeth, but was not obtained from any other locality. Male specimens were not seldom found among the females, though, as usual, not nearly so abundant as the latter.

52. CYPRIDOPSIS RENIFORMIS, n. sp.

(Plate XIV, figs. 7 and 8.)

Specific Characters—Female.—Shell, seen laterally, oblong reniform in shape, with the greatest height about in the middle and only slightly exceeding half the length, dorsal margin gently arched, ventral deeply sinuated, anterior extremity obliquely rounded, posterior somewhat deflexed and obtusely blunted at the end; seen dorsally, oblong ovate, with the greatest width behind the middle and not nearly attaining half the length, anterior extremity more pointed

than the posterior. Surface of shell distinctly granular, but sparingly hairy and without any spines.

Colour not yet ascertained.

Length of shell amounting to 0.80 mm.

Remarks.—The above-described form may be easily recognised by the pronouncedly reniform shape of the shell, a character which indeed has given rise to the specific name here proposed.

Occurrence.—Several specimens of this form, most of them of the female sex, were found in one of the alcoholic samples sent to me from the South African Museum, and taken from a pond at Fishhoek Station. It was not reared in any of my aquaria.

53. *CYPRIDOPSIS CLAVATA*, n. sp.

(Plate XIV, figs. 9 and 10.)

Specific Characters—Female.—Shell rather compressed; seen laterally, subclavate in outline, the greatest height occurring rather in front and about equalling $\frac{2}{5}$ of the length, dorsal margin angularly bent in front of the middle and declining rather steeply in front, much more slowly behind, ventral margin distinctly sinuated in the middle, anterior extremity obliquely rounded, posterior blunted; seen dorsally, narrow oblong in form, with the greatest width not nearly attaining half the length, anterior extremity more pointed than the posterior. Surface of shell without any spines and rather sparingly hairy.

Colour not yet ascertained.

Length of shell amounting to 0.78 mm.

Remarks.—This species is nearly allied to the preceding one, but may easily be distinguished by the more compressed shell and its somewhat clavate shape as seen laterally, the specific name here proposed alluding to this character.

Occurrence.—Some female specimens of this form were found in another of the alcoholic samples sent to me from the South African Museum, and taken from a dam at Touws River Station, Worcester Division.

54. *CYPRIDOPSIS TONSA*, n. sp.

(Plate XIV, figs. 11 and 12.)

Specific Characters—Female.—Shell comparatively more tumid than in the two preceding species; seen laterally, of a very broad somewhat triangular shape, greatest height about in the middle and fully attaining $\frac{2}{3}$ of the length, dorsal margin boldly arched and rather

steeply declining in front, more slowly behind, ventral margin very slightly sinuated, both extremities somewhat deflexed, the anterior one obliquely rounded, the posterior obtuse; seen dorsally, broadly ovate, with the greatest width behind the middle and considerably exceeding half the length. Surface of shell smooth and almost quite naked, with only very faint traces of hairs.

Colour not yet ascertained.

Length of shell amounting to 0.78 mm.

Remarks.—The present species may be easily recognised by the high triangular shape of the shell, as also by the very smooth appearance of its surface, the latter character having given rise to the specific name here proposed.

Occurrence.—Only some few female specimens of this form have as yet come under my notice. They were found in an alcoholic sample taken from a pond on Green Point Common.

55. CYPRIDOPSIS OCHRACEA, n. sp.

(Plate XIV, figs. 13 and 14.)

Specific Characters—Female.—Shell rather compressed; seen laterally, of an oblong trigonal form, with the greatest height somewhat in front of the middle and not fully attaining $\frac{3}{4}$ of the length, dorsal margin angularly bent just behind the ocular region and declining rather steeply both in front and behind, ventral margin slightly sinuated, anterior extremity obliquely rounded, posterior somewhat narrowly produced below; seen dorsally, narrow oblong, with the greatest width not nearly attaining half the length. Surface of shell finely granular and only sparingly hairy.

Colour light yellow or ochraceous.

Length of shell amounting to 0.78 mm.

Remarks.—The above-described species is easily recognisable from any of the other forms here recorded by the shape of the shell and its unusual colour, which is even retained in specimens for a long time preserved in alcohol.

Occurrence.—Numerous specimens of this form were contained in some of the alcoholic samples sent to me from the South African Museum, and taken at Faure on the Cape Flats, near Cape Town. I have also reared it very plentifully in some of my aquaria prepared with mud taken by Mr. Orjan Olsen near the whaling station at Saldanha Bay. Male specimens were by no means seldom, and were often seen in copulation with the females.

56. *CYPRIDOPSIS HIRSUTA*, n. sp.

(Plate XIV, figs. 15 and 16.)

Specific Characters—Female.—Shell somewhat tumid; seen laterally, of a rather regular oblong oval shape, greatest height a little in front of the middle and not fully attaining $\frac{3}{5}$ of the length, dorsal margin gently arched, ventral distinctly sinuated in the middle, anterior extremity rounded off, posterior blunted; seen dorsally, broadly ovate, with the greatest width behind the middle and nearly equalling the height, exterior extremity narrowed, posterior broadly rounded. Surface of shell all over clothed with unusually strong recurved hairs, giving it a pronouncedly hirsute appearance.

Colour not yet ascertained.

Length of shell amounting to 0.80 mm.

Remarks.—This species is especially distinguished by the unusually strong development of the hairs clothing the surface of the shell, and the specific name here proposed alludes to that character. It also differs somewhat from the other species in the general shape of the shell.

Occurrence.—Only some few female specimens of this have as yet come under my notice. They were found in an alcoholic sample taken by Dr. Purcell at Ashton.

57. *CYPRIDOPSIS ECHINATA*, G. W. Müller.

(Plate XIV, figs. 17 and 18.)

Cypridopsis echinata, G. W. Müller. L.c. p. 165, figs. 1–6 (in text).

Specific Characters—Female.—Shell moderately tumid; seen laterally, oval subreniform in shape, greatest height somewhat in front of the middle and about equalling $\frac{3}{5}$ of the length, dorsal margin abruptly bent in the ocular region and only slowly declining behind, ventral margin distinctly sinuated, anterior extremity obliquely rounded, posterior rather broader and blunted at the end; seen dorsally, ovate, with the greatest width behind and scarcely attaining the height. Surface of shell, in addition to the hairs, all over armed with comparatively short and thick curved spines, so densely crowded as partly to conceal the contours of the shell.

Colour dark green.

Length of shell amounting to 0.72 mm.

Remarks.—The above-described species is unquestionably identical with that recorded by G. W. Müller. It agrees with *C. spinosa* and

C. aculeata in the spinous armature of the shell ; but the spines are comparatively coarser and much more densely crowded. In the shape of the shell it moreover differs conspicuously from both the said species.

Occurrence.—Numerous specimens of this form were contained in one of the alcoholic samples sent to me from the South African Museum, and taken in the neighbourhood of Cape Town. It was also reared in my aquaria from the mud kindly forwarded to me from Mr. Hodgson, and derived from a vley at Port Elizabeth. The specimens examined by G. W. Müller were from the same locality, as most of the other forms recorded by him, viz. Plumstead, Cape Peninsula.

58. *CYPRIDOPSIS GLABRATA*, n. sp.

(Plate XV, figs. 1-7.)

Specific Characters—*Female*.—Shell comparatively more elongate than in most of the other species ; seen laterally, oblong oval in outline, with the greatest height about in the middle and only slightly exceeding half the length, dorsal margin gently arched, ventral slightly sinuated, both extremities rounded off and nearly equal ; seen dorsally, narrow oblong, with the greatest width not nearly attaining half the length, both extremities obtusely pointed. Surface of shell smooth and polished, wanting the usual densely granular sculpture, and only sparingly hairy.

Male of somewhat smaller size than female, with the dorsal face of the shell less vaulted, being, moreover, easily recognisable by the densely coiled spermathecal tubes shining through the valves both in their anterior and posterior parts.

Colour dark olivaceous.

Length of shell amounting to 0.87 mm.

Remarks.—This is a very distinct and easily recognisable species, differing rather conspicuously from the other known forms, both as to the shape and the structure of the shell. It is, however, a true member of the present genus, as proved by the structure of the several appendages. On the accompanying plate some details of the male are given, viz. the prehensile palps of the maxillipeds, the ejaculatory tube, and the copulatory appendages. The structure of these appendages does not, however, differ materially from that found in other species of the present genus.

Occurrence.—This form developed rather abundantly in some of my aquaria prepared with mud taken by Mr. Orjan Olsen from small

dried-up pools near the whaling station at Saldanha Bay. It occurred here, together with two other species of *Cypridopsis*, viz. *C. gregaria* and *C. ochracea*, from which it could at once be distinguished by its more elongated shell and the dark olivaceous colour of the latter. Male specimens were by no means rare, and were often seen in copulation with the females. I have not obtained this species from any other locality.

59. *CYPRIDOPSIS TRIGONELLA*, n. sp.

(Plate XV, figs. 8-11.)

Specific Characters—Female.—Shell moderately tumid; seen laterally, short subtriangular in outline, greatest height in the middle and about equalling $\frac{3}{5}$ of the length, dorsal margin evenly rounded behind, but forming in the middle an abrupt, almost angular bend, ventral margin slightly sinuated, anterior extremity somewhat produced and obliquely rounded at the end, posterior rather broader and somewhat deflexed; seen dorsally, oblong ovate, with the greatest width behind the middle and about equalling half the length, anterior extremity more pointed than the posterior. Surface of shell very smooth and only sparingly hairy; left valve, as in the species of the genus *Pionocypris*, armed along the anterior edge with a row of minute tubercles, but quite smooth behind.

Colour light green, with a more or less distinct orange tinge on the posterior part of the shell, chiefly caused by the translucent ripe ova.

Length of shell scarcely exceeding 0.63 mm.

Remarks.—This is one of the smaller species of the genus, and may, moreover, be recognised by the smooth subtrigonal shell and, when examined in the living state, also by its colour.

Occurrence.—Specimens of this form have been obtained from several of my aquaria prepared with mud taken in the neighbourhood of Bergvliet. They were all of the female sex.

60. *CYPRIDOPSIS PYRAMIDATA*, n. sp.

(Plate XV, figs. 12 and 13.)

Specific Characters—Female.—Shell very high; seen laterally, of an almost pyramidal shape, with the greatest height considerably exceeding $\frac{2}{3}$ of the length, dorsal margin gibbously projecting in the middle and sloping steeply both in front and behind, ventral margin nearly straight, both extremities somewhat deflexed and rounded off

at the ends ; seen dorsally, oblong ovate in shape, with the greatest width behind the middle and not fully attaining half the length. Surface of shell conspicuously sculptured with closely set pits, but only sparingly hairy.

Colour not yet ascertained.

Length of shell measuring 0.59 mm.

Remarks.—This form seems to be nearest related to the above-described species *C. tonsa*, but is of much inferior size, and also differs conspicuously in the shape and sculpture of the shell.

Occurrence.—Two female specimens only of this form have as yet come under my notice. They were found in an alcoholic sample taken by Dr. Purcell from a pond at Ashton.

61. *CYPRIDOPSIS STRIOLATA*, n. sp.

(Plate XV, figs. 14–16.)

Specific Characters—*Female*.—Shell, seen laterally, oblong reniform in shape, with the greatest height somewhat in front of the middle and only slightly exceeding half the length, dorsal margin somewhat abruptly bent in front, but rather slowly declining behind, ventral margin deeply sinuated, anterior extremity broadly rounded, posterior somewhat obliquely deflexed ; seen dorsally, of the usual oblong ovate shape, with the greatest width about equalling half the length. Surface of shell only sparingly hairy, but sculptured with very delicate, though easily observable longitudinal striae partly anastomosing with each other at both extremities.

Colour dark greenish.

Length of shell measuring 0.54 mm.

Remarks.—This form may be at once distinguished from any of the other known species of the present genus by the peculiar sculpture of the shell, a character which indeed has given rise to the specific name here proposed.

Occurrence.—Some few female specimens of this form were found in one of my aquaria prepared with mud taken by Dr. Purcell from a pond on the Bergvliet Flats.

62. *CYPRIDOPSIS BREVIS*, n. sp.

(Plate XV, figs. 17 and 18.)

Specific Characters—*Female*.—Shell unusually short and stout ; seen laterally, rounded oval in outline, greatest height somewhat behind the middle and nearly attaining $\frac{2}{3}$ of the length, dorsal margin rather

evenly arched, ventral slightly sinuated, anterior extremity obliquely produced, posterior broadly rounded; seen dorsally, regularly ovate, with the greatest width behind the middle and exceeding half the length. Surface of shell smooth, but rather densely hairy; left valve, as in *C. trigonella*, armed a little inside the anterior edge with a row of minute tubercles.

Colour bright emerald green.

Length of shell scarcely exceeding 0.50 mm.

Remarks.—This form is easily recognised from most of the other known species by the comparatively short and stout shape of the shell, resembling in this respect more the species of the genus *Pionocypris*. It is, however, a true *Cypridopsis*, as proved by the mutual relation of the valves.

Occurrence.—Two female specimens only of this form have as yet come under my notice. They were found in one of my aquaria prepared with mud taken by Dr. Purcell from a pond on the Bergvliet Flats.

63. *CYPRIDOPSIS TUMIDULA*, n. sp.

(Plate XV, figs. 19–22.)

Specific Characters—Female.—Shell unusually tumid; seen laterally, broadly oval in outline, greatest height about in the middle and fully attaining $\frac{3}{5}$ of the length, dorsal margin evenly arched and joining the hind edge without any intervening angle, ventral margin distinctly sinuated in the middle, anterior extremity obliquely rounded, posterior more obtuse and somewhat deflexed; seen dorsally, broadly ovate, with the greatest width behind the middle and almost attaining $\frac{2}{3}$ of the length, anterior extremity pointed, posterior obtuse. Surface of shell smooth and rather densely hairy in front and behind.

Male, as usual, smaller than female, and having the shell comparatively shorter and more dilated in its posterior part. Spermathecae very conspicuous, forming dense coils both in the anterior and posterior parts of the valves. Outer lamella of the copulatory appendages drawn out at the end to a beak-like incurved process.

Colour not yet ascertained.

Length of shell measuring in female 0.58 mm., in male 0.50 mm.

Remarks.—This form also exhibits a rather anomalous appearance, though being unquestionably, like the preceding one, a member of the present genus. It is especially distinguished by the unusually tumid shell, a character which indeed has given rise to the specific name here proposed.

Occurrence.—On examining closer an alcoholic sample taken from one of my aquaria prepared with mud from the neighbourhood of Port Elizabeth, I found several specimens of this small Ostracod which previously had escaped my attention. Most of the specimens were of the female sex; but also a few males occurred, one of which is figured on the accompanying plate, together with the left copulatory appendage.

64. CYPRIDOPSIS PYGMAEA, n. sp.

(Plate XV, figs. 23 and 24.)

Specific Characters—*Female.*—Shell rather compressed; seen laterally oblong oval in outline, greatest height about in the middle and only slightly exceeding half the length, dorsal margin gently arched and declining more steeply in front than behind, ventral margin slightly sinuated, anterior extremity narrowly rounded, posterior somewhat broader and blunted at the end; seen dorsally, narrow oblong, with the greatest width scarcely exceeding $\frac{2}{5}$ of the length. Surface of shell smooth and rather densely hairy.

Colour not yet ascertained.

Length of shell scarcely exceeding 0.45 mm.

Remarks.—This is much the smallest of the species here recorded, and may, moreover, easily be recognised by its comparatively narrow and compressed shell.

Occurrence.—Two female specimens only of this form, the one with ripe ova in the body cavity, were picked up from an alcoholic sample taken from one of my aquaria prepared with mud from the Cape Flats, kindly sent to me from Dr. Purcell.

GEN. 20. CYPRILLA, n.

Generic Characters.—Shell compressed, and of somewhat different shape in the different species. Valves of rather firm consistency and very conspicuously unequal, the right one being, as a rule, considerably higher than the left, and accordingly overlapping it for some space dorsally, being, however, itself overlapped by that valve both anteriorly and posteriorly. Natatory setae on the posterior antennae in some cases rudimentary, but more generally well developed. Maxillary palp rather strong, with the terminal joint spatulate in form and edged with coarse spiniform setae; masticatory lobes short and thick. Maxillipeds without any branchial plate. Legs normally

developed. Caudal rami rudimentary, resembling in structure those in *Cypridopsis*.

Remarks.—The present new genus seems to approach somewhat the genus *Potamocypris* of Brady, but differs in the general appearance of the shell and in the mutual relation of the valves, as also apparently in the sculpture. Five well-defined species of this genus will be described below. They are all of very small size.

65. CYPRILLA ARCUATA, n. sp.

(Plate XVI, figs. 1–11.)

Specific Characters.—*Female*.—Shell short and stout; seen laterally, almost hemispherical in outline, greatest height about in the middle and nearly attaining $\frac{2}{3}$ of the length, dorsal margin forming a bold and quite even curve declining almost perpendicularly behind, ventral margin very slightly sinuated, anterior extremity bluntly rounded at the end, posterior drawn out below to a short lobiform corner; seen dorsally, oblong ovate, with the greatest width not fully attaining $\frac{2}{3}$ of the length. Valves very unlike in shape, the right one being considerably higher than the left, but far less produced at the extremities, and overlapped by it in front by a thin projecting border, behind by the above-mentioned lobiform corner. Surface of shell sculptured with well-marked and rather densely set pits, and clothed at both extremities with delicate hairs. Natatory setae of the posterior antennae very poorly developed, extending scarcely beyond the middle of the penultimate joint.

Colour more or less dark green.

Length of shell scarcely exceeding 0.48 mm.

Remarks.—The above-described form may be regarded as the type of the present genus. It is easily recognised by the short and high, almost hemispherical shape of the shell as seen laterally, as also by the imperfect development of the natatory setae on the posterior antennae.

Occurrence.—This small Ostracod developed in considerable numbers in some of my aquaria prepared with mud from the neighbourhood of Bergvliet, and was also occasionally found in the alcoholic samples sent to me from the South African Museum. The animal is quite destitute of swimming power, and of course it was only found on the bottom of my aquaria among the loose mud. For obtaining the specimen, it sufficed in many cases to take up by the aid of a dipping-tube a small parcel of the mud and to place it, together with some

water, in a shallow watch-glass for observation. After some time the specimens were seen slowly emerging from the mud and congregating at the lighter side of the watch-glass, where they could be removed easily, and placed under the microscope for examination. By this means I have been enabled to collect a considerable number of specimens, all of them being, however, of the female sex.

66. CYPRILLA GIBBULA, n. sp.

(Plate XVI, figs. 12–15.)

Specific Characters—Female.—Shell more compressed than in the preceding species; seen laterally, of a somewhat trigonal or rather semilunar shape, with the greatest height almost attaining $\frac{2}{3}$ of the length, dorsal margin strongly arched, forming in the middle an abrupt, almost gibbous bend, and declining rather steeply both in front and behind, ventral margin very distinctly concaved, both extremities somewhat deflexed, the anterior one bluntly rounded at the end, the posterior terminating below in a rather projecting corner; seen dorsally, narrow oblong or lanceolate, with the greatest width scarcely exceeding $\frac{2}{5}$ of the length, anterior extremity more pointed than the posterior. Valves exhibiting a similar very conspicuous unequalness to that in the preceding species. Surface of shell distinctly sculptured with rather large and somewhat distant pits, and clothed at each extremity with delicate hairs. Natatory setae on the posterior antennae well developed, extending to the tips of the apical claws.

Colour pale greenish.

Length of shell measuring 0.48 mm.

Remarks.—In its general appearance this form somewhat resembles the preceding one, but may, on a closer examination, be easily distinguished by the gibbously projecting upper face of the shell, the deeply concaved ventral face, and the more produced and deflexed extremities. It also differs in the much more full development of the natatory setae.

Occurrence.—This form also was found in several of my aquaria, but not nearly in such abundance as the preceding one. In accordance with the well-developed natatory setae, the animal is enabled to move rather quickly through the water, though more generally keeping to the bottom. Among the specimens obtained only a single male was detected.

67. CYPRILLA DEFLEXA, n. sp.

(Plate XVI, figs. 16-22.)

Specific Characters.—*Female*.—Shell less compressed than in the preceding species; seen laterally, of a somewhat irregular oval quadrangular shape, greatest height in front of the middle and about equalling $\frac{3}{5}$ of the length, dorsal margin forming both in front and behind an abrupt bend, its middle part being only slightly arched and obliquely declining behind, ventral margin distinctly concaved, anterior extremity obliquely deflexed and projecting below in a very conspicuous rounded lobe sharply marked off from the inferior edge, posterior extremity almost transversely truncated and expanded below to a somewhat similar lobe to that of the anterior; seen dorsally, oblong ovate, with the greatest width behind the middle and almost attaining half the length. Valves very unequal, the deflexed lobes at both ends of the shell being almost exclusively formed by the left valve, which, on the other hand, is considerably overlapped by the right along the dorsal face. Surface of shell only sparingly hairy, but very coarsely sculptured, being all over covered with densely crowded knots, which give it a very rough appearance. Natatory setae well developed.

Male somewhat smaller than female, but resembling it in the general shape of the shell. Prehensile palps of maxillipeds only slightly unequal, proximal joint of both rather narrow and armed near the end inside with a short deflexed spine, distal joint claw-like, and comparatively broader in the right than in the left palp. Ejaculatory tubes each with about sixteen chitinous whorls. Outer lamella of the copulatory appendages comparatively small and narrow, with a short prominence inside the tip.

Colour pale yellowish, with a slight green tinge.

Length of shell measuring in female 0.60 mm., in male 0.56 mm.

Remarks.—The present form may be easily distinguished from the two preceding species by the rather different shape of the shell, as also by its very coarse sculpture. The specific name here proposed alludes to the peculiar deflexed lobes occurring at both extremities of the shell and chiefly formed by the right valve.

Occurrence.—Several specimens, both males and females, of this distinct species were found in one of my aquaria prepared with mud from the neighbourhood of Port Elizabeth. I have not obtained this form from any other locality.

68. *CYPRILLA HUMILIS*, n. sp.

(Plate XVI, figs. 23 and 24.)

Specific Characters—Female.—Shell much compressed; seen laterally, of a somewhat clavate shape, greatest height quite in front and only slightly exceeding half the length, dorsal margin angularly bent in the ocular region and nearly straight in the middle, declining obliquely behind, ventral margin distinctly sinuated, anterior extremity rather broad and obliquely deflexed, terminating below in a broadly rounded expansion, posterior extremity almost transversely truncated and drawn out below to a rounded lobule; seen dorsally, narrow lanceolate in shape, with the greatest width scarcely exceeding $\frac{1}{3}$ of the length. Valves somewhat less unequal than in the other species, the right one scarcely projecting beyond the left along the dorsal face, but distinctly overlapped by that valve in front and behind. Surface of shell exhibiting a similar sculpture to that in the type species, and clothed in front and behind with delicate hairs.

Colour not yet ascertained.

Length of shell measuring 0.58 mm.

Remarks.—This form also is easily recognisable by the shape of the shell, which appears rather unlike that in the other species, its dorsal face being far less vaulted, a character which has given rise to the specific name here proposed.

Occurrence.—Only a very restricted number of specimens of this form have as yet come under my notice. They were picked up from an alcoholic sample taken from a dam at Faure on the Cape Flats, and containing multitudes of *Cypridopsis ochracea*. One of the specimens obtained was of the male sex.

69. *CYPRILLA PRODUCTA*, n. sp.

(Plate XVI, figs. 25 and 26.)

Specific Characters—Female.—Shell comparatively more elongate than in the other species; seen laterally, oblong semilunar in outline, greatest height in the middle and scarcely exceeding half the length, dorsal margin quite evenly arched throughout, ventral margin distinctly concaved, both extremities deflexed and remarkably produced, the anterior one obtusely blunted at the end, the posterior drawn out to a rather projecting rounded lobe; seen dorsally, lanceolate in shape, with the greatest width scarcely exceeding $\frac{1}{3}$ of the length. Valves very unequal, the right one projecting considerably beyond

the left along the dorsal face, being, however, overlapped by that valve very distinctly at both extremities. Surface of shell smooth and polished, though, when examined by a high magnifying power, exhibiting a very fine punctation, both extremities clothed with scattered delicate hairs. Natatory setae well developed.

Colour pale yellowish, with a slight green tinge, and clouded dorsally by an irregular dark shadow.

Length of shell amounting to 0.60 mm.

Remarks.—This is a very distinct and easily recognisable species, differing conspicuously from the preceding ones, both in the shape of the shell and in its sculpture. It is, however, unquestionably congeneric with them, as proved by the mutual relation of the valves and by the structure of the several appendages.

Occurrence —Some specimens of this handsome species, both males and females, were reared in one of my aquaria prepared with mud taken by Mr. J. H. Power at Klipdam, near Kimberley, and kindly forwarded to me from the South African Museum. I have not obtained this form from any other locality.

FAM. CYTHERIDAE.

GEN. 21. GOMPHOCYTHERE, n.

Generic Characters.—Shell of rather firm consistency, and very unlike in the two sexes, being much larger in female than in male and remarkably swollen in its posterior part, to form a roomy incubatory cavity for the reception of the ripe ova; ventral face of shell in both sexes flattened and defined on each side by a more or less projecting longitudinal ridge. Eye single, median. Antennae, oral parts, and legs built on a similar type to that in *Limnocythere*. Caudal rami however very different and of a rather peculiar structure, forming two juxtaposed thin lamella curving anteriorly, each terminating in a digitiform acutely pointed lappet, at the base of which, outside, a plumosa seta is attached; posterior (dorsal) edge of each lamella divided into three successive short linguiform lobules clothed at the tip with long diverging cilia. Copulatory appendages of male very massive, each terminating in a movable irregularly quadrangular plate.

Remarks.—This new genus is somewhat allied to *Limnocythere*, but differs conspicuously in some points both from this and most other Cytheridean genera. Among the most prominent distinguishing

characters may be here noted the very peculiar structure of the caudal rami, and the presence in the female of a roomy incubatory cavity, causing a very conspicuous transformation of the shell in that sex. The generic name here proposed alludes to this latter character. Two well-defined species of this genus will be described below.

70. GOMPHOCY THERE OBTUSATA (G. O. Sars).

(Plate XVII, figs. 1-16.)

Limnocythere obtusata, G. O. Sars. Zool. Results of the Third Tanganyika Expedition. Ostracoda. Proc. Zool. Soc. London, 1910, p. 754, pl. lxxiii, figs. 8-14.

Specific Characters—Female.—Shell, seen laterally, regularly oblong quadrangular in outline and nearly equally high throughout, the height scarcely attaining half the length, dorsal margin straight and horizontal, forming both in front and behind a distinct angular bend, frontal angle the more prominent, ventral margin slightly sinuated, anterior extremity broadly rounded, posterior blunted; seen dorsally, of a somewhat irregular ovate shape, considerably bulging behind and exhibiting in front of the middle a well-marked constriction, greatest width almost attaining half the length, anterior extremity narrowed, posterior broadly rounded off. Valves nearly equal and each exhibiting in front a rather broad marginal zone crossed by narrow septa, longitudinal ridges, defining at the sides the ventral face, not very sharply marked. Surface of shell of a dull appearance, being sculptured all over with well marked pits, and provided at both extremities with scattered stiff hairs, most of them arising from small tubercles of the shell. Muscular impressions in the centre of each valve four in number and arranged in a regular vertical series.

Male considerably smaller than female and having the shell much more compressed, its posterior part being scarcely at all expanded, longitudinal ridges defining at the sides the ventral face, sharply marked.

Colour not yet ascertained.

Length of shell measuring in female 0.80 mm., in male 0.70 mm.

Remarks.—This species was described in the year 1910 by the present author from some female specimens obtained in the great Central African lake, Victoria Nyanza, but was at that time referred to the genus *Limnocythere*. Having, however, now had an opportunity of renewing my investigation of this form in both sexes and, moreover,

of examining another nearly related species, I have convinced myself of its real generic difference. As the present species is that at first described, it ought of course to be regarded as the type of the new genus.

Occurrence.—Some specimens of this form were contained in one of the alcoholic samples sent to me from the South African Museum, and taken from a small duck-pond at Salt River, near Cape Town. It was also present rather abundantly in the mud taken by Mr. Orjan Olsen from small pools near the whaling station at Saldanha Bay, and, though the mud had remained dry for rather a long time, in some of the specimens all the limbs were still present within the shell and in such a perfect condition as to admit an exact examination. I did not however succeed in raising either this or the next form in any of my aquaria, apparently because no true resting ova are produced by these Ostracods.

71. GOMPHOCYTHERE EXPANSA, n. sp.

(Plate XVII, figs. 17–22.)

Specific Characters.—*Female*.—Shell much more tumid than in the preceding species; seen laterally, of a somewhat irregular oval quadrangular shape, with the height about half the length, dorsal margin slightly depressed in the middle and forming in front, above the eye, a slight angular bend, whereas behind it joins the posterior edge by a quite even curve, ventral margin scarcely at all sinuated, anterior extremity obliquely rounded, posterior blunted and conspicuously deflexed, forming below a projecting rounded expansion; seen dorsally, very broad, almost pentagonal in outline, with the posterior part very much expanded, the greatest width even exceeding somewhat $\frac{2}{3}$ of the length, anterior extremity narrowed to an acute point, posterior broadly truncated. Ventral face of the shell flattened and defined on each side by a very sharply marked ridge. Surface of shell distinctly and rather regularly reticulated, and clothed in front and behind with scattered remarkably strong curved hairs arising from projecting tubercles. Structure of the several appendages almost exactly as in the preceding species.

Male much smaller than female and having the shell far less tumid, though somewhat less compressed than in the male of the type species.

Colour not yet ascertained.

Length of shell measuring in female 0.77 mm., in male 0.69 mm.

Remarks.—The above-described species, though closely allied to the preceding one, is easily distinguishable from it in both sexes.

Especially is the female highly remarkable by its exceedingly tumid and expanded shell, the specific name here proposed alluding to this character.

Occurrence.—Some well-preserved specimens of this form were found in one of the alcoholic samples sent to me from the South African Museum, and taken from a pond on the Cape Flats, and, on a closer examination of a parcel of dried mud from about the same region, a considerable number of shells of the same remarkable species were picked out, some of them still containing the several appendages in a condition suitable for an exact examination.

NOTE.

Two species of Ostracoda formerly recorded by the present author as belonging to the Fauna of the Cape Province, are omitted in this paper, viz. *Cyclocypris pusilla* and *Candonocypris candonoides*. The first-named form I suspect is not a true *Cyclocypris*; but as the specimens originally examined unfortunately have been lost, I am unable to determine its real systematic position. As regards the last-named form too, I am now much inclined to believe that it does not at all belong to the African Fauna. True, some specimens of this form were found in one of my aquaria prepared with mud from the Knysna swamp; but these I think were hardly developed from the mud, and might more properly have been accidentally transferred from another aquarium which I had under observation at the very same time. This latter aquarium, which was prepared with Australian mud, abounded with specimens of *Candonocypris*, and as the same dipping-tube was used for taking up proofs of both these aquaria, a transfer of ova or young from the one to the other aquarium might very easily have happened. *Candonocypris candonoides* seems in reality to be a true endemic form, not found, as far as I know, outside the limits of the Australian continent.

ADDENDUM.

GEN. 2. PSEUDOCYPRIS, Daday.

Remarks.—Two new species, evidently referable to this genus, will be described in the following pages. One of these species is only

represented by a solitary male specimen ; but of the other species a sufficient number of specimens, both females and males, are present, to allow a more complete anatomical examination than was possible with the rather scanty material formerly at my disposal. I have therefore convinced myself on the very close relationship which the present genus exhibits to the genus *Cypris* (gens. strict.). Indeed, I am quite unable to find any essential difference between these two genera, in the structure of the several appendages, as seen by comparing the detail figures given on the accompanying plate, and it thus remains to be decided, if the peculiar character of the shell and the bisexual nature of the species can be regarded as sufficient for supporting the present genus.

72. PSEUDOCYPRIS TRIQUETRA, n. sp.

(Plate XX, figs. 1-15.)

Specific Characters—Female.—Shell comparatively short and stout, with the dorsal face strongly vaulted, the ventral flattened, sole-like, and defined on each side by a well-marked, though not much prominent sharp crest, greatest height of the shell somewhat in front of the middle and about equalling $\frac{2}{3}$ of the length, dorsal margin considerably arched in front, ventral margin almost straight, anterior extremity broadly rounded, posterior somewhat obliquely deflexed and terminating below in an obtuse corner ; seen dorsally, rhomboid in shape, with the greatest width about equalling $\frac{2}{3}$ of the length, latero-ventral crest only visible in the middle of each valve as a very slight prominence. Surface of shell nearly smooth, with only scattered small pits, and clothed in front and behind with short and delicate hairs. Caudal rami of moderate length and slightly flexuous ; apical claws slender and rather unequal, the larger one almost attaining the length of the ramus.

Male of about same size as female and having the shell of a quite similar shape. Spermatie tubes forming dense coils both in the anterior and posterior parts of the valves. Prehensile palps of maxillipeds only slightly unequal, hand expanded at the end inside to a triangular lappet, dactylus abruptly bent and somewhat broader on the right than on the left palp. Copulatory appendages with the outer lamella drawn out inside to a narrow rostriform lappet. Ejaculatory tubes with very numerous densely crowded chitinous whorls.

Colour not yet ascertained.

Length of adult female 2.60 mm.

Remarks.—According to the structure of the shell, this form is unquestionably referable to the genus *Pseudocypris* Daday, though the characteristic latero-ventral expansions of the valves are far less prominent than in any of the other species and almost invisible in the dorsal aspect of the shell.

Occurrence.—Several specimens of this easily recognisable form were contained in the material received, having been collected at Kimberley by Mr. J. H. Power.

73. *PSEUDOCYPRIS EXPANSA*, n. sp.

(Plate XVIII, figs. 1 and 2.)

Specific Characters—*Male.*—Shell, seen laterally, resembling somewhat in shape that of the preceding species, though comparatively rather stouter, with the dorsal margin more evenly arched and the posterior extremity less oblique; seen dorsally, broadly cordate in outline, with the latero-ventral expansion projecting on each side in the middle as broad semilunar lamellae. Structure of the several appendages scarcely differing from that in the preceding species.

Colour not yet ascertained.

Length of adult male 2.90 mm.

Remarks.—The present species is closely allied to the preceding one, but of somewhat larger size, and moreover at once distinguished by the much fuller development of the latero-ventral expansions of the valves, giving the shell in the dorsal aspect a rather peculiar appearance.

Occurrence.—A solitary male specimen of this form was found in the same tube as the preceding species, from Kimberley.

8. *PSEUDOCYPRIS TESTUDO*, G. O. Sars.

(Plate XVIII, figs. 3 and 4.)

Remarks.—The specimens of this remarkable species formerly examined by me were somewhat defective and apparently not fully grown. In the material now received two well-preserved and fully adult female specimens were present, measuring in length no less than 3.50 mm. One of these specimens is figured on the accompanying plate for comparison with the other two species. They were both taken from a pond on the Cape Flats, collected by Mr. K. H. Barnard.

EXPLANATION OF PLATES.

PLATE II.

Eucypris trichota (G. W. Müller).

FIG.

1. Adult female, viewed from left side.
2. Same, dorsal view.
3. Anterior antenna.
4. Posterior antenna.
5. Anterior lip.
6. Mandible, with palp.
7. Maxilla, with branchial plate.
8. Maxilliped.
9. Anterior leg.
10. Posterior leg.
11. Caudal ramus.

Eucypris Purcelli, n. sp.

12. Adult female, seen from left side.
13. Same, dorsal view.
14. Left valve with enclosed animal, somewhat more highly magnified.
15. Right valve, seen from the inner face.

PLATE III.

Eucypris producta, n. sp.

1. Adult female, viewed from left side.
2. Same, dorsal view.

Eucypris corpulenta, G. O. Sars.

3. Adult female, viewed from left side.
4. Same, dorsal view.

Eucypris hirta, n. sp.

5. Adult female, viewed from left side.
6. Same, dorsal view.

Eucypris trigona, G. O. Sars.

7. Adult female, viewed from left side.
8. Same, dorsal view.

Eucypris capensis (G. W. Müller).

9. Adult female, viewed from left side.
10. Same, dorsal view.

Pseudocypris testudo, n. sp.

11. Adult female, dorsal view.
12. Same, front view.
13. Right valve, seen from the inner face.
14. Posterior antenna.

FIG.

15. Terminal part of maxilla.
16. Anterior leg.
17. Caudal ramus.

PLATE IV.

Heterocypris incongruens (Ramdohr).

1. Adult female, viewed from right side.
2. Same, dorsal view.

Heterocypris aurea, G. O. Sars.

3. Adult female, viewed from right side.
4. Same, dorsal view.

Heterocypris capensis (G. W. Müller).

5. Adult female, viewed from right side.
6. Same, dorsal view.
7. Right valve, seen from the inner face.
8. Adult male, viewed from right side.
9. Anterior antenna.
10. Posterior antenna.
11. Mandible, with palp.
12. Maxilla, with branchial plate.
13. Maxilliped.
14. Anterior leg.
15. Posterior leg.
16. Caudal ramus.
17. Right maxilliped of male.
18. Prehensile palp of left maxilliped
19. Ejaculatory tube.
20. Copulatory appendages.

PLATE V.

Homocypris conoidea, n. sp.

1. Adult female, viewed from right side.
2. Same, dorsal view.
3. Adult male, viewed from left side.
4. Posterior antenna.
5. Maxilla, without the branchial lamella.
6. Anterior leg.
7. Caudal ramus.
8. Prehensile palp of right male maxilliped.
9. Palp of left maxilliped.
10. Ejaculatory tube.
11. Left copulatory appendage.

Cypricercus cuneatus, G. O. Sars.

12. Adult female, viewed from right side.
13. Same, dorsal view.
14. Adult male, viewed from left side.
15. Palp of right male maxilliped.
16. Palp of left maxilliped.

FIG.

17. Ejaculatory tube.
18. Left copulatory appendage.
19. Caudal ramus.

Cypricercus episphaena, G. W. Müller.

20. Adult female, viewed from right side.
21. Same, dorsal view.
22. Posterior antenna.
23. Terminal part of maxilla.
24. Anterior leg.
25. Palp of right male maxilliped.
26. Palp of left maxilliped.
27. Ejaculatory tube.
28. Left copulatory appendage.

PLATE VI.

Stenocypris Hodgsoni, n. sp.

1. Adult female, viewed from left side.
2. Same, dorsal view.
3. Adult male, viewed from right side.
4. Anterior antenna.
5. Posterior antenna.
6. Maxilla, without the branchial plate.
7. Anterior leg.
8. Posterior leg.
9. Palp of left male maxilliped.
10. Palp of right maxilliped.
11. Right copulatory appendage.
12. Caudal rami.

Stenocypris olivacea, n. sp.

13. Adult female, viewed from left side.
14. Same, dorsal view.
15. Palp of right male maxilliped.
16. Palp of left maxilliped.
17. Left copulatory appendage.
18. Extremity of left caudal ramus.

Stenocypris smaragdina, n. sp.

19. Adult female, viewed from left side.
20. Same, dorsal view.
21. Caudal rami.
22. Right male maxilliped.
23. Palp of left maxilliped.
24. Copulatory appendages, together with left ejaculatory tube.

PLATE VII.

Stenocypris pardalis, n. sp.

1. Adult female, viewed from right side.
2. Same, dorsal view.

Stenocypris perarmata, Brady.

FIG.

3. Adult female, viewed from left side.
4. Same, dorsal view.

Sclerocypris clavularis, n. sp.

5. Adult female, viewed from right side.
6. Same, dorsal view.
7. Right valve of adult male, viewed from the inner face.
8. Posterior antenna.
9. Anterior lip.
10. Maxilla.
11. Maxilliped.
12. Anterior leg.
13. Posterior leg.
14. Caudal ramus.
15. Palp of male maxilliped.
16. Ejaculatory tube.
17. Copulatory appendages.

Herpetocypris Chevreuxi, G. O. Sars.

18. Adult female, viewed from left side.
19. Same, dorsal view.
20. Posterior antenna.
21. Terminal part of maxilla.
22. Caudal ramus.

PLATE VIII.

Megalocypris d'Urbani (Baird).

1. Adult female, viewed from left side.
2. Same, dorsal view.
3. Adult male, viewed from right side.
4. Young specimen, seen from left side.
5. Anterior antenna.
6. Posterior antenna.
7. Mandible, with palp.
8. Maxilla, with branchial plate.
9. Maxilliped.
10. Anterior leg.
11. Posterior leg.
12. Caudal ramus.
13. Right male maxilliped.
14. Terminal claw of palp of left maxilliped.
15. Right copulatory appendage.
16. Ejaculatory tube.

Megalocypris princeps, G. O. Sars.

17. Adult female, viewed from right side.
18. Same, dorsal view.

PLATE IX.

Isocypris nivea, n. sp.

FIG.

1. Adult female, viewed from left side.
2. Same, dorsal view.
3. Anterior antenna.
4. Posterior antenna.
5. Mandible, with palp.
6. Maxilla, with branchial plate.
7. Maxilliped.
8. Anterior leg.
9. Posterior leg.
10. Caudal ramus.
11. Maxilliped of male.
12. Copulatory appendages.
13. Ejaculatory tube.

Isocypris priomena, G. W. Müller.

14. Adult female, viewed from left side.
15. Same, dorsal view.
16. Posterior antenna.
17. Caudal ramus.

Ilyocypris australiensis, G. O. Sars.

18. Adult female, viewed from left side.
19. Same, dorsal view.
20. Posterior antenna.
21. Terminal part of maxilla.
22. Maxilliped.
23. Anterior leg.
24. Posterior leg.
25. Caudal ramus.

PLATE X.

Cypria capensis, G. O. Sars.

1. Adult female, viewed from right side.
2. Same, dorsal view.
3. Adult male, viewed from left side.
4. Posterior antenna.
5. Terminal part of same antenna in male.
6. Mandible, with palp.
7. Terminal part of maxilla.
8. Maxilliped.
9. Anterior leg.
10. Posterior leg.
11. Caudal ramus.
12. Palp of right male maxilliped.
13. Palp of left maxilliped.
14. Copulatory appendages.
15. Ejaculatory tube.

Bradycypris intumescens (Brady).

FIG.

16. Adult female, viewed from right side.
17. Same, dorsal view.
18. Posterior antenna.
19. Terminal part of maxilla.
20. Maxilliped.
21. Anterior leg.
22. Posterior leg.
23. Caudal ramus.
24. Palp of right male maxilliped.
25. Palp of left maxilliped.
26. Left copulatory appendage.
27. Ejaculatory tube.

Cypretta turgida, G. O. Sars.

28. Adult female, viewed from left side.
29. Same, dorsal view.
30. Posterior antenna.
31. Terminal part of maxilla.
32. Maxilliped.
33. Caudal ramus.

PLATE XI.

Cypretta minna (King).

1. Adult female, viewed from left side.
2. Same, dorsal view.

Cypretta globulus, G. O. Sars.

3. Adult female, viewed from left side.
4. Same, dorsal view.

Zonocypris cordata, n. sp.

5. Adult female, viewed from right side.
6. Same, dorsal view.
7. Left valve, seen from the inner face.
8. Anterior antenna.
9. Posterior antenna.
10. Mandible, with palp.
11. Terminal part of maxilla.
12. Maxilliped.
13. Anterior leg.
14. Posterior leg.
15. Caudal ramus, with adjacent part of body.

Zonocypris tuberosa, G. W. Müller.

16. Adult female, dorsal view.
17. Same, viewed from right side.
18. Posterior antenna.
19. Caudal rami.
20. Part of shell, highly magnified, to show the sculpture.

FIG.

21. Terminal part of a posterior antenna in male.
22. Palp of left male maxilliped.
23. Palp of right maxilliped.
24. Ejaculatory tube.
25. Copulatory appendages.

PLATE XII.

Paracyprretta ampullacea, n. sp.

1. Adult female, viewed from right side.
2. Same, dorsal view.
3. Same, front view.
4. Left valve, seen from the inner face.
5. Anterior antenna.
6. Posterior antenna.
7. Anterior and posterior lips, viewed from left side.
8. Mandible, with palp.
9. Maxilla, without the branchial plate.
10. Maxilliped.
11. Anterior leg.
12. Posterior leg.
13. Caudal ramus.

Paracyprretta rubra, n. sp.

14. Adult female, viewed from right side.
15. Same, dorsal view.

Paracyprretta acanthifera, n. sp.

16. Adult female, viewed from right side.
17. Same, dorsal view.

PLATE XIII.

Pionocypris assimilis (G. O. Sars).

1. Adult female, viewed from right side.
2. Same, dorsal view.
3. Right valve, seen from the inner face.
4. Posterior antenna.
5. Terminal part of maxilla.
6. Maxilliped.
7. Anterior leg.
8. Posterior leg.
9. Caudal rami, dorsal view.
10. Right caudal ramus, seen laterally.

Pionocypris intermedia, n. sp.

11. Adult female, viewed from right side.
12. Same, dorsal view.

Pionocypris viduella (G. O. Sars).

13. Adult female, viewed from right side.
14. Same, dorsal view.

Cypridopsis gregaria (G. O. Sars).

FIG.

15. Adult female, viewed from left side.
16. Same, dorsal view.
17. Adult male, viewed from right side.
18. Posterior antenna.
19. Maxilla, without the branchial plate.
20. Maxilliped.
21. Anterior leg.
22. Posterior leg.
23. Caudal ramus.
24. Palp of right male maxilliped.
25. Palp of left maxilliped.
26. Ejaculatory tube.
27. Copulatory appendages.

PLATE XIV.

Cypridopsis spinifera, n. sp.

1. Adult female, viewed from left side.
2. Same, dorsal view.

Cypridopsis aculeata (Costa).

3. Adult female, viewed from left side.
4. Same, dorsal view.

Cypridopsis Elizabethae, n. sp.

5. Adult female, viewed from left side.
6. Same, dorsal view.

Cypridopsis reniformis, n. sp.

7. Adult female, viewed from left side.
8. Same, dorsal view.

Cypridopsis clavata, n. sp.

9. Adult female, viewed from left side.
10. Same, dorsal view.

Cypridopsis tonsa, n. sp.

11. Adult female, viewed from left side.
12. Same, dorsal view.

Cypridopsis ochracea, n. sp.

13. Adult female, viewed from left side.
14. Same, dorsal view.

Cypridopsis hirsuta, n. sp.

15. Adult female, viewed from left side.
16. Same, dorsal view.

Cypridopsis echinata, G. W. Müller.

17. Adult female, viewed from left side.
18. Same, dorsal view.

PLATE XV.

Cypridopsis glabrata, n. sp.

FIG.

1. Adult female, viewed from left side.
2. Same, dorsal view.
3. Adult male, viewed from right side.
4. Palp of right male maxilliped.
5. Palp of left maxilliped.
6. Copulatory appendages.
7. Ejaculatory tube.

Cypridopsis trigonella, n. sp.

8. Adult female, viewed from left side.
9. Same, dorsal view.
10. Anterior part of shell, seen from left side ; more highly magnified.
11. Left valve, seen from the inner face.

Cypridopsis pyramidata, n. sp.

12. Adult female, viewed from left side.
13. Same, dorsal view.

Cypridopsis striolata, n. sp.

14. Adult female, viewed from left side.
15. Same, dorsal view.
16. Left valve, seen from the inner face.

Cypridopsis brevis, n. sp.

17. Adult female, viewed from left side.
18. Same, dorsal view.

Cypridopsis tumidula, n. sp.

19. Adult female, viewed from left side.
20. Same, dorsal view.
21. Adult male, viewed from right side.
22. Left copulatory appendage.

Cypridopsis pygmaea, n. sp.

23. Adult female, viewed from left side.
24. Same, dorsal view.

PLATE XVI.

Cyprilla arcuata, n. sp.

1. Adult female, viewed from left side.
2. Same, dorsal view.
3. Left valve, seen from the inner face.
4. Right valve, seen from the inner face.
5. Posterior antenna.
6. Mandible, with palp.
7. Maxilla, without the branchial plate.

FIG.

8. Maxilliped.
9. Anterior leg.
10. Posterior leg.
11. Caudal ramus, with adjoining part of body.

Cyprilla gibbula, n. sp.

12. Adult female, viewed from left side.
13. Same, dorsal view.
14. Anterior antenna.
15. Terminal part of posterior antenna.

Cyprilla deflexa, n. sp.

16. Adult female, viewed from left side.
17. Same, dorsal view.
18. Adult male, viewed from right side.
19. Palp of left male maxilliped.
20. Palp of right maxilliped.
21. Left copulatory appendage.
22. Ejaculatory tube.

Cyprilla humilis, n. sp.

23. Adult female, viewed from left side.
24. Same, dorsal view.

Cyprilla producta, n. sp.

25. Adult female, viewed from left side.
26. Same, dorsal view.

PLATE XVII.

Gomphocythere obtusata, G. O. Sars.

1. Adult female, viewed from left side.
2. Same, dorsal view.
3. Adult male, viewed from right side.
4. Same, ventral view.
5. Right valve of an adult female, with enclosed animal ; left valve removed.
6. Same valve of an adult male, exhibiting the enclosed animal.
7. Anterior antenna.
8. Posterior antenna.
9. Anterior lip, seen from left side.
10. Mandible, with palp.
11. Maxilla, with branchial plate.
12. First leg (maxilliped).
13. Second leg.
14. Third leg.
15. Posterior part of body of a female, with caudal lamella and genital lobe, viewed from left side.
16. Right copulatory appendage of male.

Gomphocythere expansa, n. sp.

FIG.

17. Adult female, viewed from left side.
18. Same, dorsal view.
19. Same, ventral view.
20. Left valve, seen from the inner face.
21. Adult male, viewed from right side.
22. Same, ventral view.

PLATE XVIII.

Pseudocypris expansa, n. sp.

1. Adult male, viewed from left side.
2. Same, dorsal view.

Pseudocypris testudo, G. O. Sars.

3. Adult female, viewed from left side.
4. Same, dorsal view.

Liocypris grandis, n. sp.

5. Adult female, viewed from left side
6. Same, dorsal view.
7. Posterior antenna.
8. Outer part of maxilla.
9. Maxilliped.
10. Anterior leg.
11. Posterior leg.
12. Caudal ramus.
13. Left genital lobe.
14. Palp of right maxilliped of male.
15. Palp of left maxilliped.
16. Left copulatory appendage.

PLATE XIX.

Isocypris perangusta, G. W. Müller.

1. Adult female, viewed from left side.
2. Same, dorsal view.
3. Anterior marginal zone of a valve, more highly magnified.

Isocypris priomena, G. W. Müller.

4. Adult female, viewed from left side.
5. Anterior marginal zone of a valve, more highly magnified.
6. Part of ventral margin behind.
7. Caudal ramus.

Cypricercus maculatus, G. W. Müller

8. Adult male, viewed from right side.
9. Same, dorsal view.
10. Right maxilliped.
11. Caudal ramus.
12. Left copulatory appendage.
13. Ejaculatory tube.

Stenocypris pectinata, n. sp.

FIG.

14. Adult female, viewed from left side.
15. Same, dorsal view.
16. Posterior corner of right valve, seen from the inner face, more highly magnified.
17. Caudal rami.

Stenocypris declivis, n. sp.

18. Adult female, viewed from left side.
19. Same, dorsal view.
20. Caudal rami.

Stenocypris ametra, G. W. Müller.

21. Adult female, viewed from left side.
22. Same, dorsal view.
23. Caudal rami.

PLATE XX.

Pseudocypris triquetra, n. sp.

1. Adult female, viewed from left side.
2. Same, ventral view.
3. Same, dorsal view.
4. Same, frontal view.
5. Posterior antenna.
6. Anterior and posterior lips, seen from left side.
7. Outer part of maxilla.
8. Maxilliped.
9. Anterior leg.
10. Posterior leg.
11. Caudal ramus.
12. Left maxilliped of male.
13. Palp of right maxilliped.
14. Ejaculatory tube.
15. Copulatory appendages.

Megalocypris hispida, n. sp.

16. Adult female, viewed from left side.
17. Same, dorsal view.
18. Posterior antenna.
19. Left maxilliped of male.
20. Palp of right maxilliped.
21. Caudal ramus.
22. Left copulatory appendage.

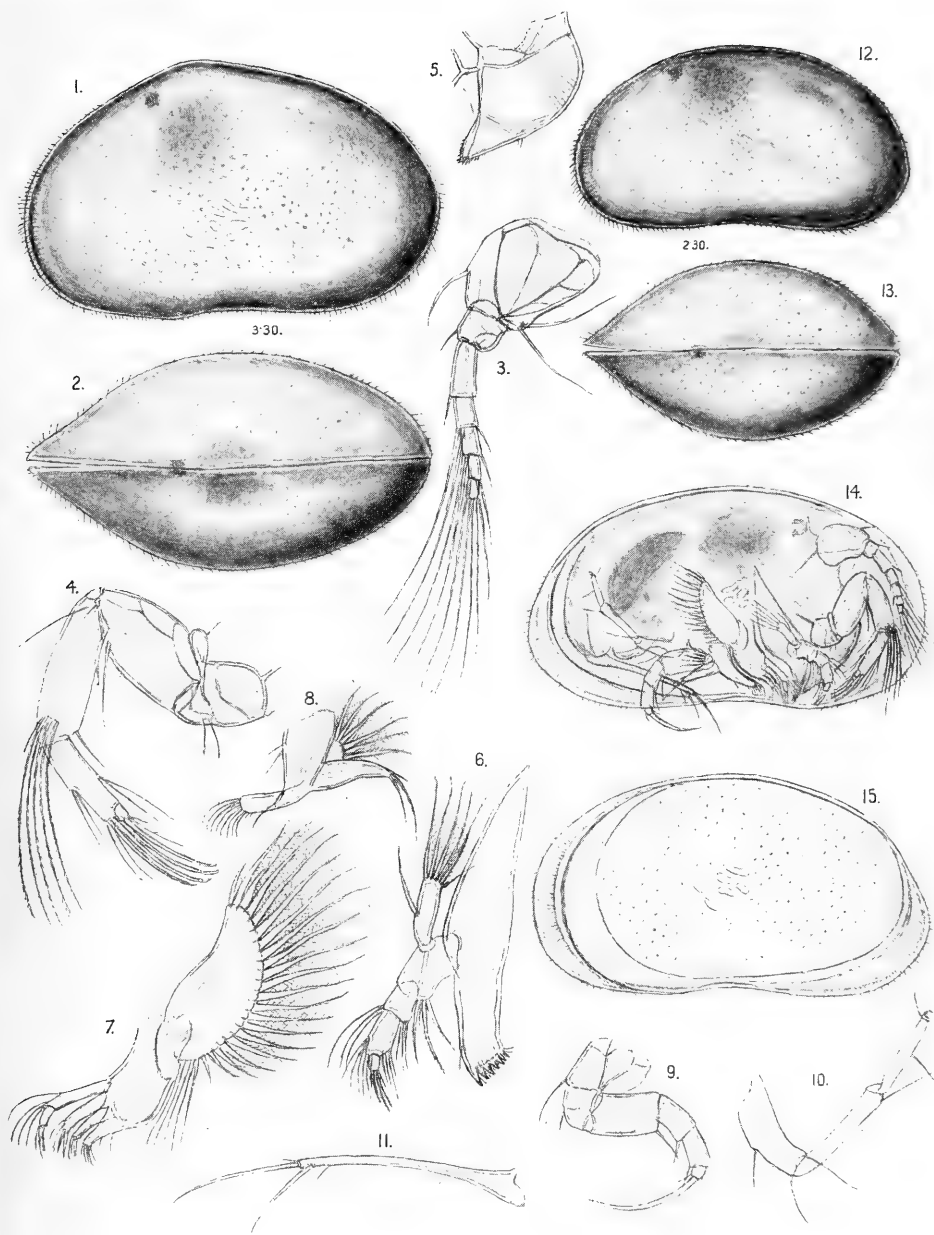
Megalocypris tuberculata, n. sp.

23. Adult female, viewed from left side.
24. Same, dorsal view.
25. Posterior antenna.
26. Palp of left maxilliped in male.
27. Caudal ramus.
28. Left copulatory appendage.

INDEX.

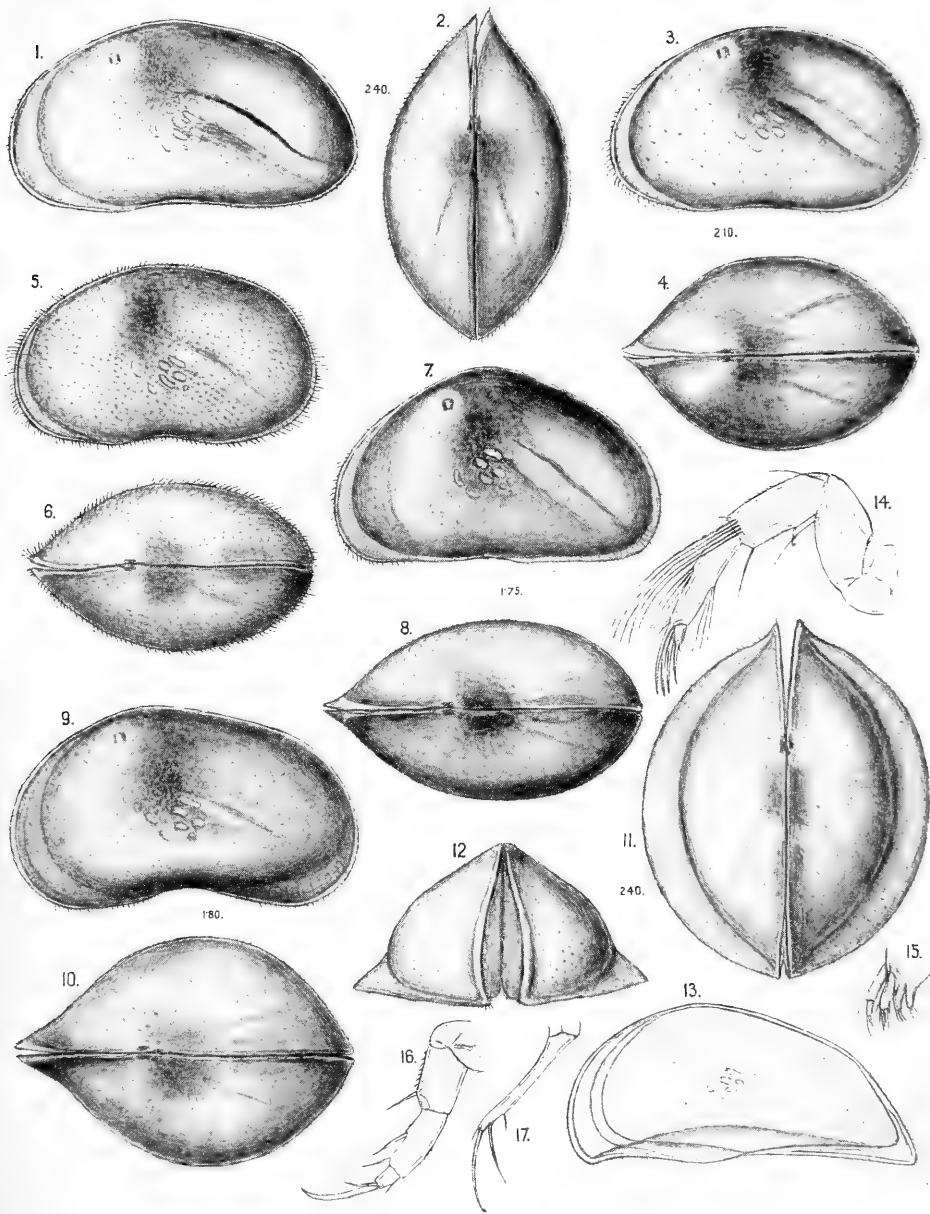
A		G	
acanthifera (Paracypretta)	PAGE 154	expansa (Gomphocythere)	PAGE 176
aculeata (Cypridopsis)	160	expansa (Pseudocypris)	179
africana (<i>Hyalocypris</i>)	142		
ametra (Stenocypris)	130		
ampullacea (Paracypretta)	153		
arcuata (Cyprilla)	170		
armata (Cypria)	144		
assimilis (Pionocypris)	155		
aurea (Heterocypris)	117		
australiensis (Ilyocypris)	143		
B		H	
Bradycypris	145	<i>Helena</i> (<i>Erpetocypris</i>)	133
brevis (Cypridopsis)	167	Herpetocypris	133
		Heterocypris	115
C		hirsuta (Cypridopsis)	164
Candonocypris	177	hirta (Eucypris)	110
candonoides (Candonocypris)	177	hispida (Megalocypris)	137
capensis (Cypria)	144	<i>Hodgsoni</i> (Megalocypris)	134
capensis (Eucypris)	112	<i>Hodgsoni</i> (Stenocypris)	124
capensis (Heterocypris)	118	Homocypris	119
Chevreauxi (Herpetocypris)	133	humilis (Cyprilla)	173
clavata (Cypridopsis)	162	<i>Hyalocypris</i>	139
clavularis (Sclerocypris)	131		
conoidea (Homocypris)	119		
cordata (Zonocypris)	150		
corpulenta (Eucypris)	110		
<i>costata</i> (Cyprilla)	148		
cuneatus (Cypricerus)	121		
Cyclocypris	177		
Cypretta	147		
Cypria	144		
Cypricerus	120		
CYPRIDAE	107		
CYPRIDIDAE	107		
Cypridopsis	157		
Cyprilla	169		
<i>Cyprinotus</i>	116		
<i>Cypris</i>	107		
CYTHERIDAE	174		
D		I	
declivis (Stenocypris)	129	Ilyocypris	143
deflexa (Cyprilla)	172	incongruens (Heterocypris)	116
d'Urbani (Megalocypris)	134	intermedia (Pionocypris)	156
		intumescens (Bradycypris)	146
E		Isocypris	139
echinata (Cypridopsis)	164		
Elizabethae (Cypridopsis)	161		
episphaena (Cypricerus)	122		
<i>Erpetocypris</i>	133		
Eucypris	107		
		L	
		<i>Limnocythere</i>	175
		Liocypris	114
		M	
		maculatus (Cypricerus)	123
		Megalocypris	134
		minna (Cyprilla)	148
		N	
		nivea (Isocypris)	140
		O	
		obtusata (Gomphocythere)	175
		ochracea (Cypridopsis)	163
		olivacea (Stenocypris)	125
		P	
		Paracypretta	152
		pardalis (Stenocypris)	127
		pectinata (Stenocypris)	129

	PAGE		PAGE
perangusta (Isocypris) . . .	142	spinifera (Cypridopsis) . . .	159
perarmata (Stenocypris) . . .	128	Stenocypris . . .	124
Pionocypris . . .	155	striolata (Cypridopsis) . . .	167
Potamocypris . . .	158		
princeps (Megalocypris) . . .	136	T	
priomena (Isocypris) . . .	141	testudo (Pseudocypris) . . .	113, 179
producta (Cyprilla) . . .	173	tonsa (Cypridopsis) . . .	162
producta (Eucypris) . . .	109	trichota (Eucypris) . . .	108
Pseudocypris . . .	112, 177	trigona (Eucypris) . . .	111
Purcelli (Eucypris) . . .	108	trigonella (Cypridopsis) . . .	166
pusilla (Cyclocypris) . . .	177	triquetra (Cypridopsis) . . .	158
pygmaea (Cypridopsis) . . .	169	triquetra (Pseudocypris) . . .	178
pyramidata (Cypridopsis) . . .	166	tuberculata (Megalocypris) . . .	138
		tuberosa (Zonocypris) . . .	151
R		tumidula (Cypridopsis) . . .	168
radiata (Cypris) . . .	146	turgida (Cyprretta) . . .	147
reniformis (Cypridopsis) . . .	161		
rubra (Paracyprretta) . . .	154	V	
		viduella (Pionocypris) . . .	157
S			
Sclerocypris . . .	131	Z	
smaragdina (Stenocypris) . . .	126	Zonocypris . . .	150



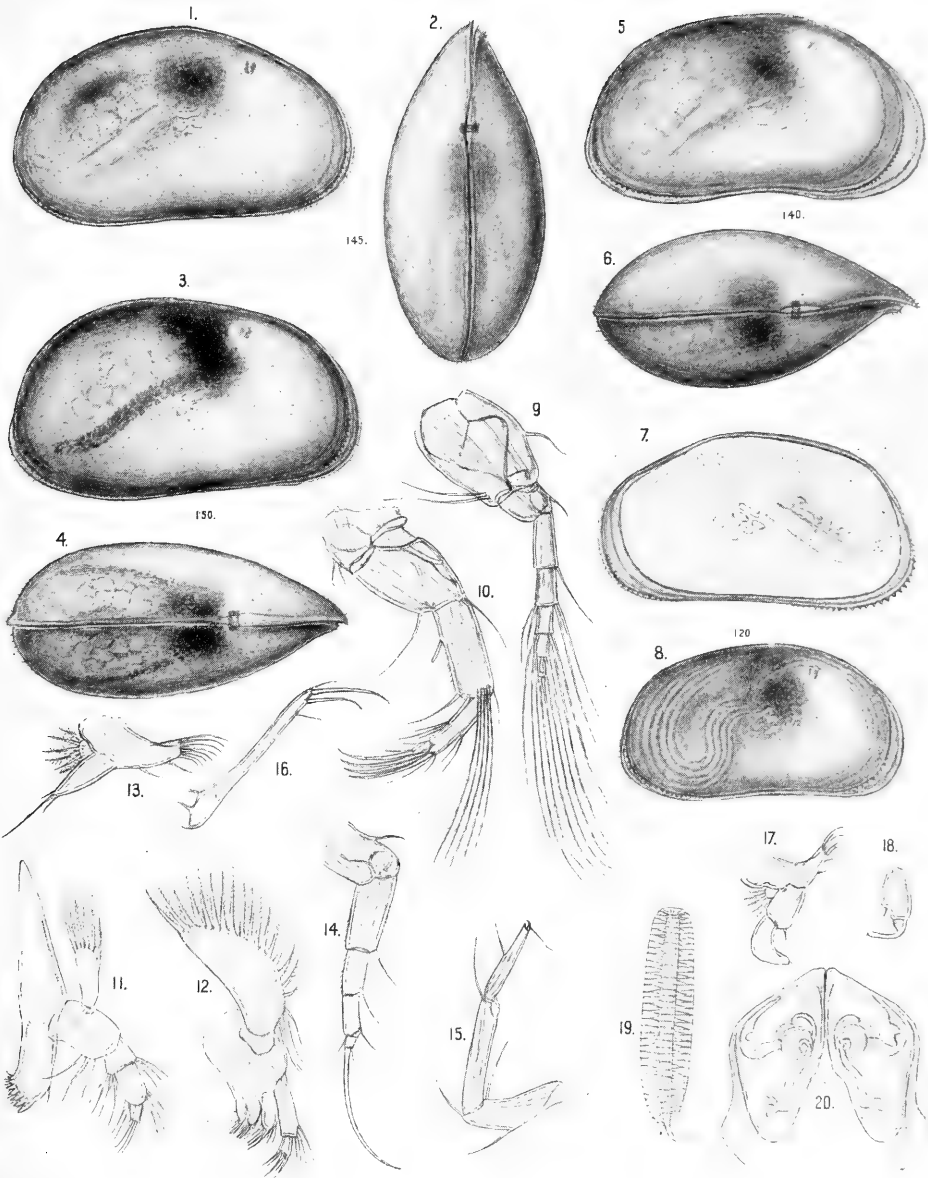
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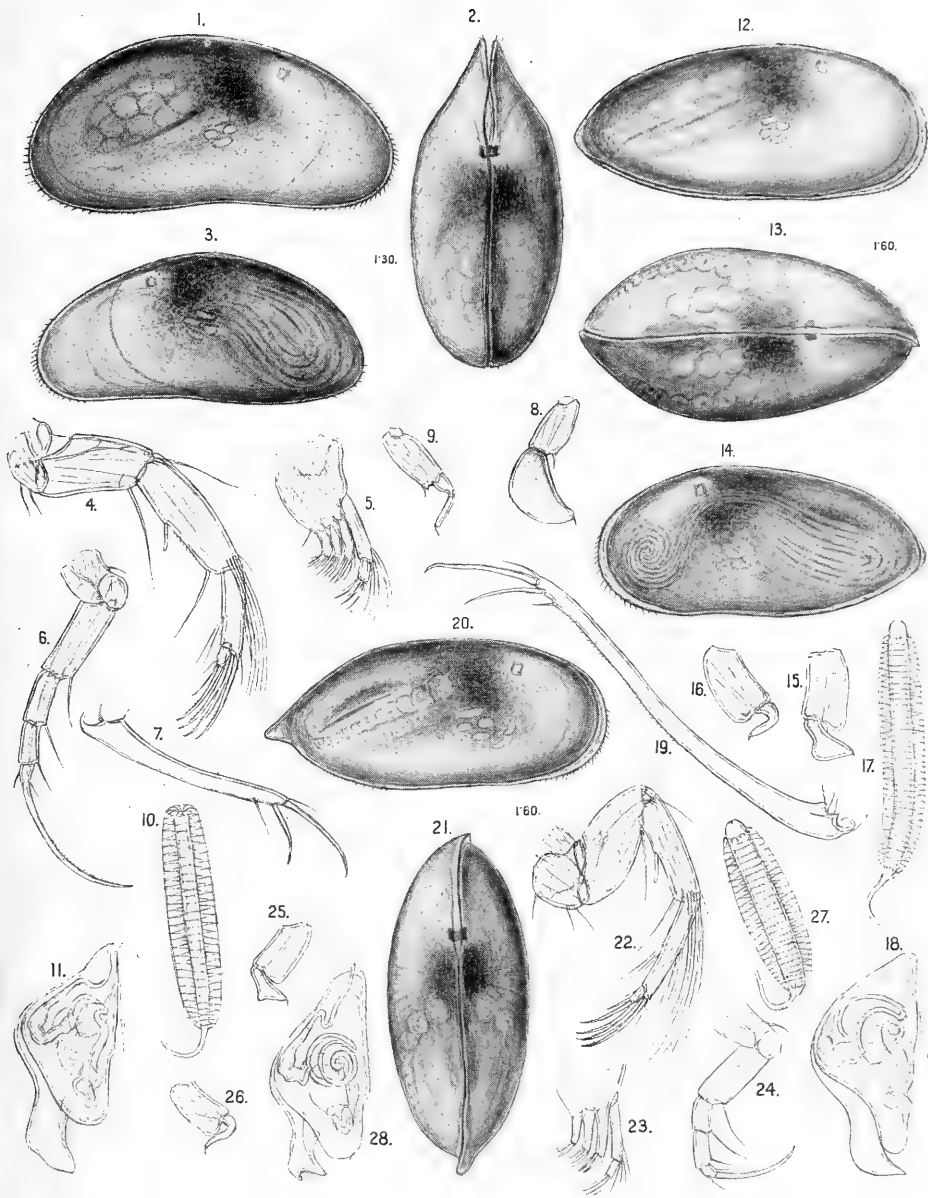
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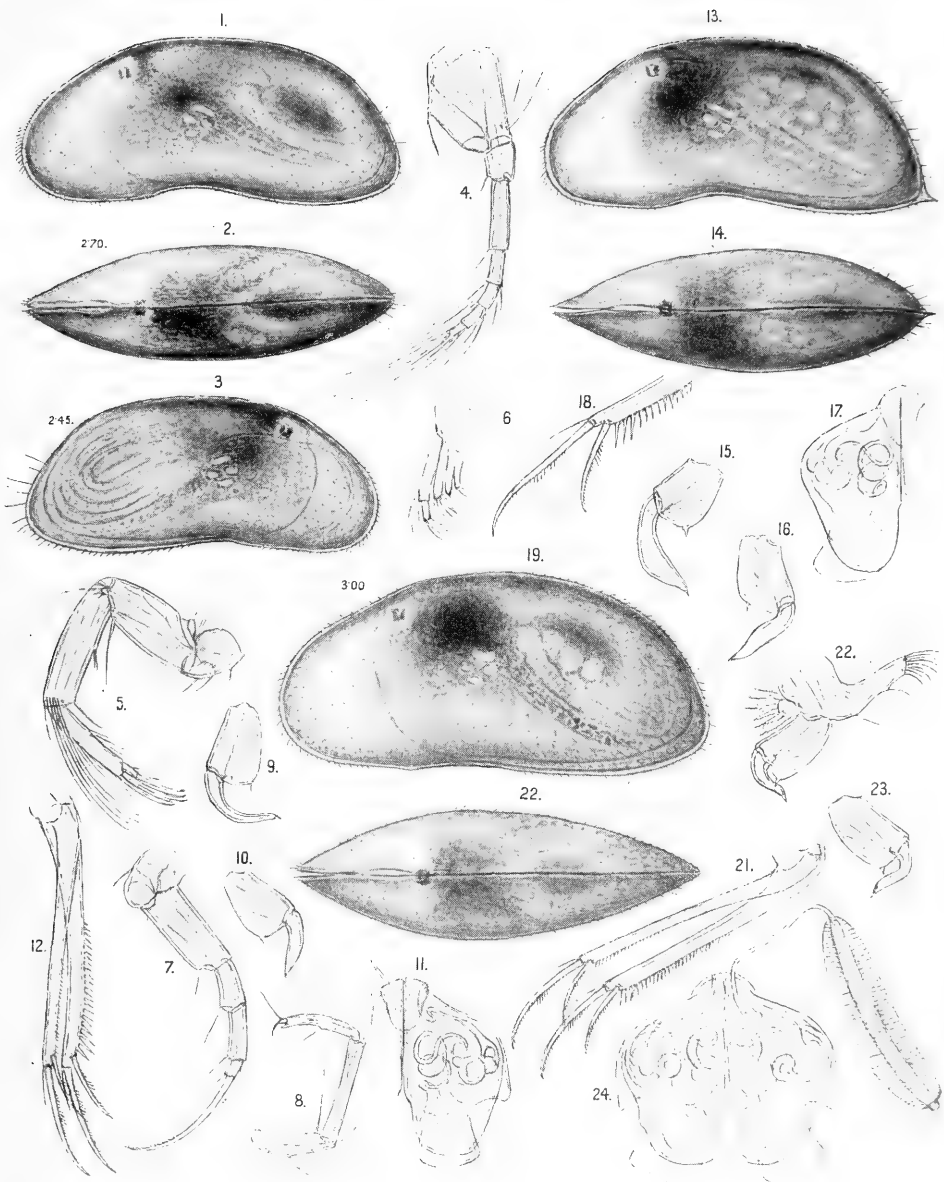
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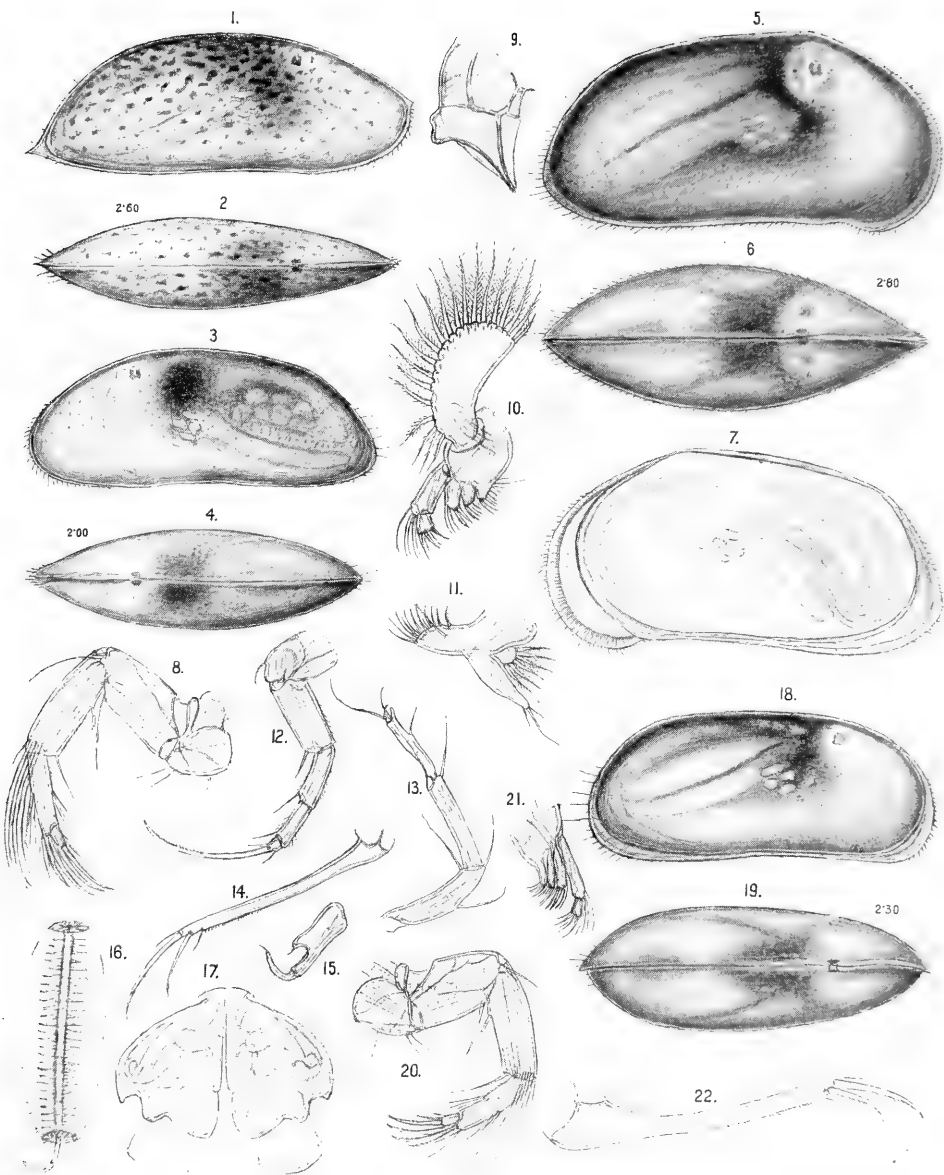
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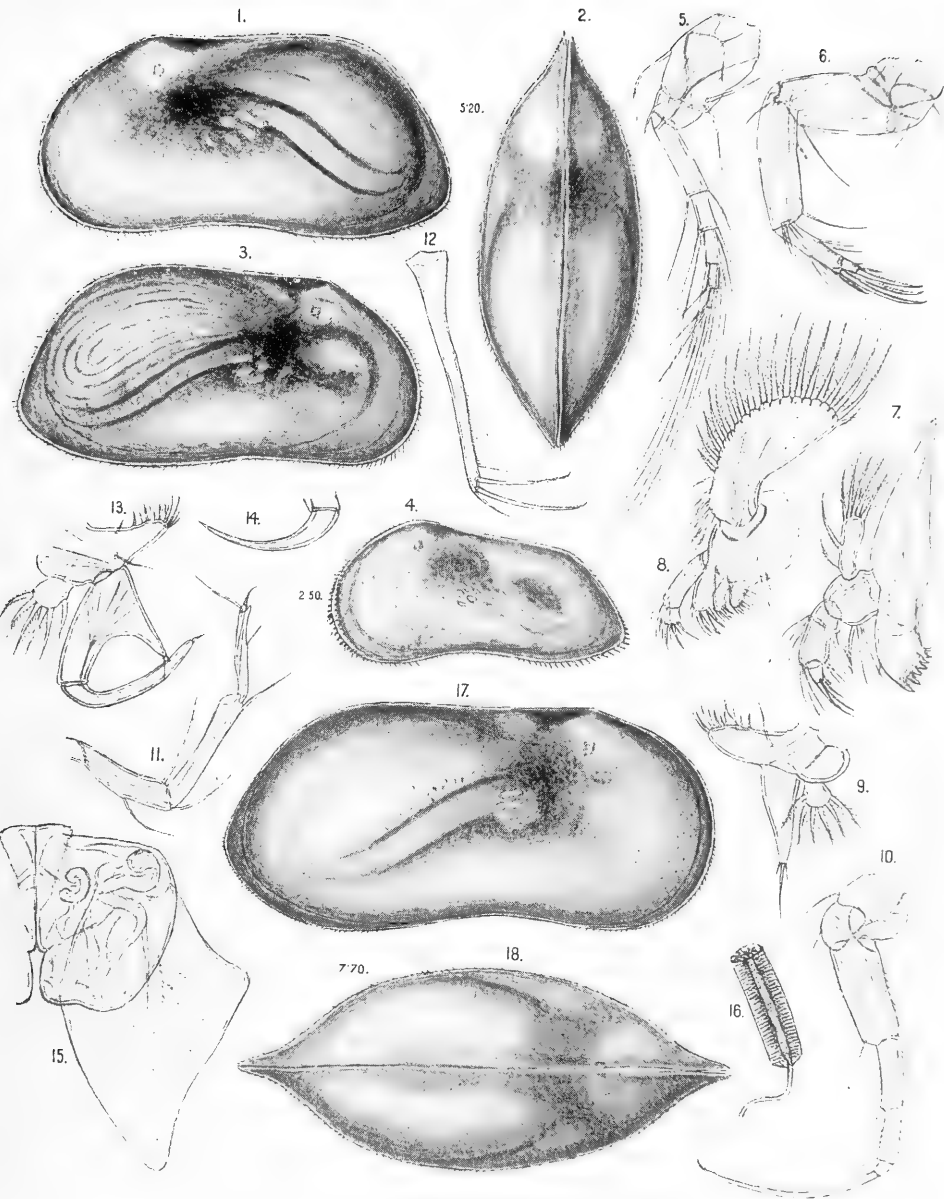
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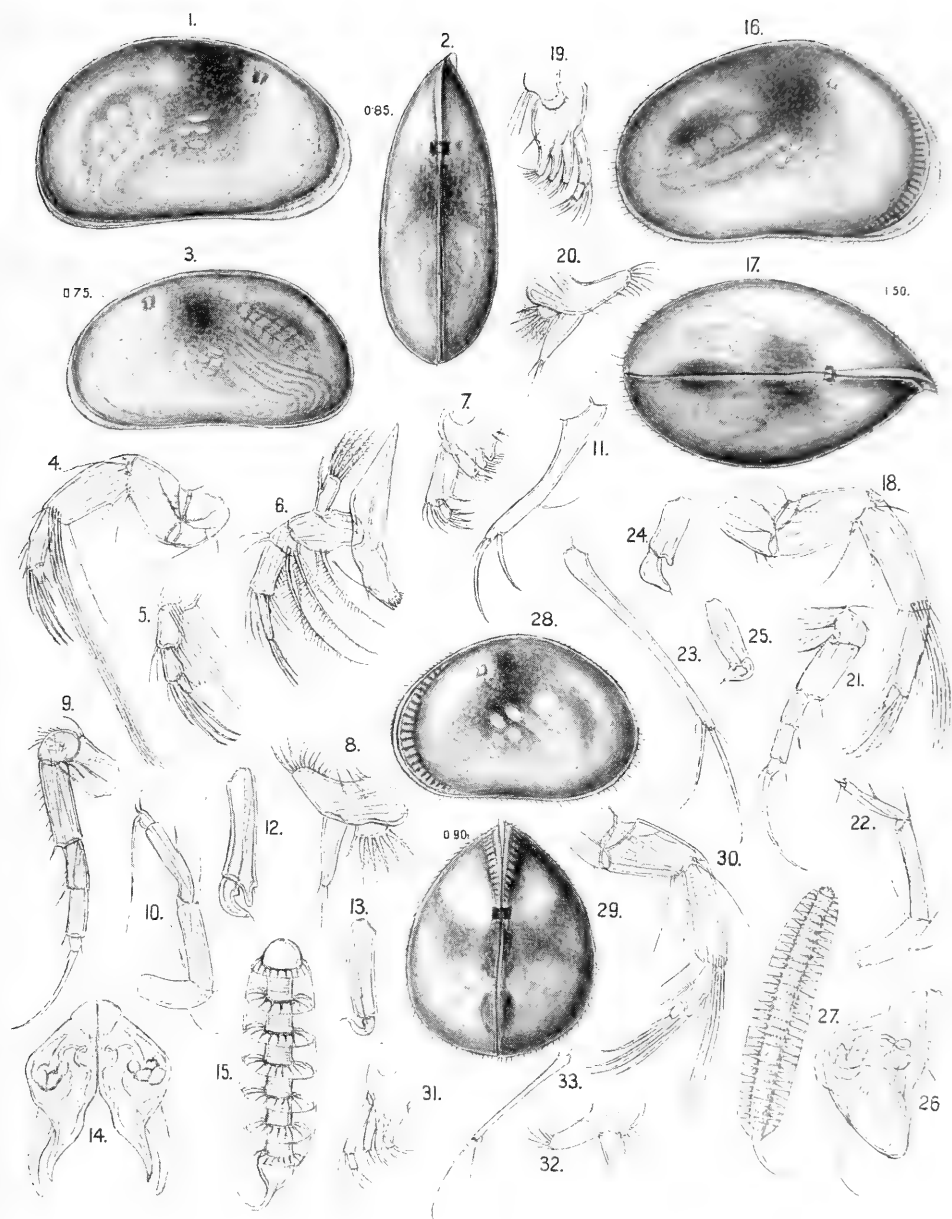
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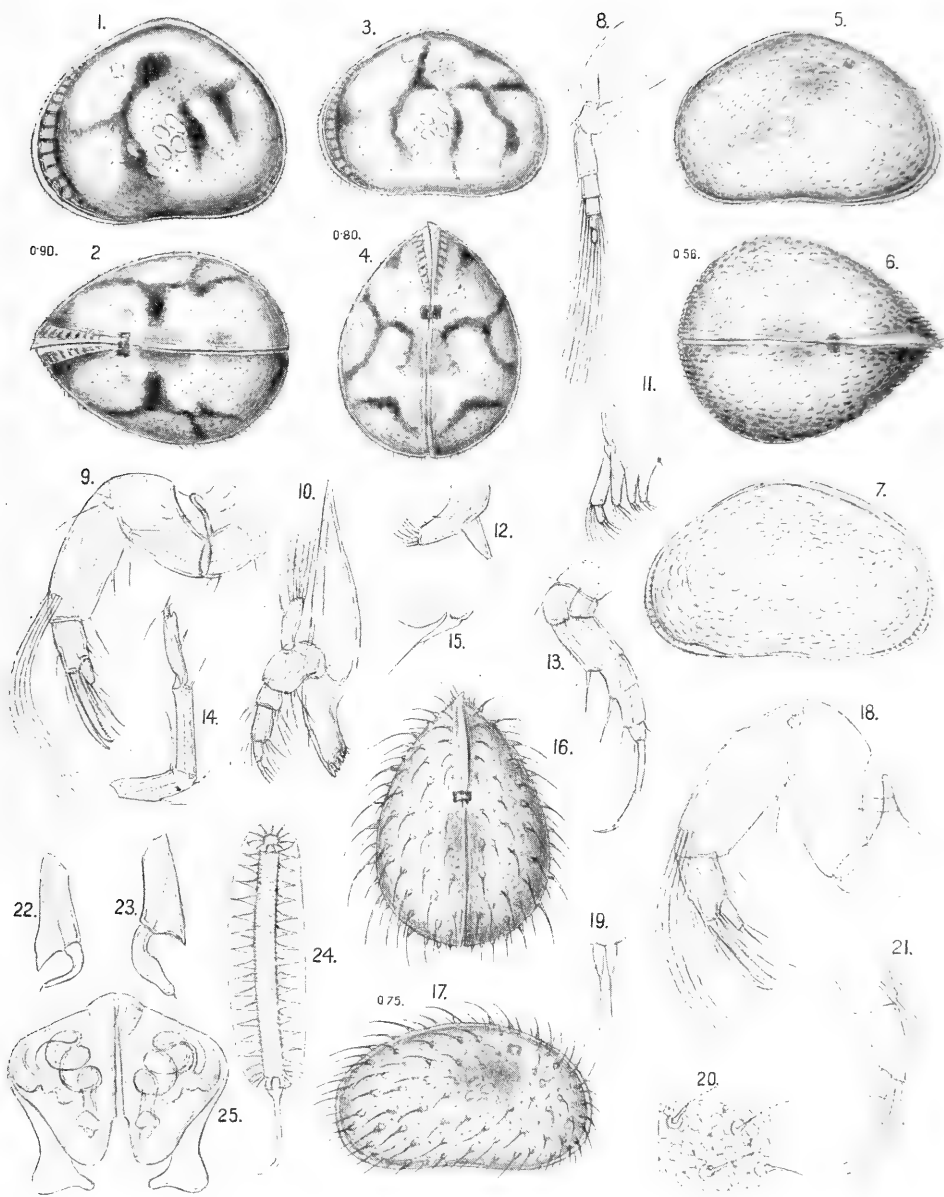
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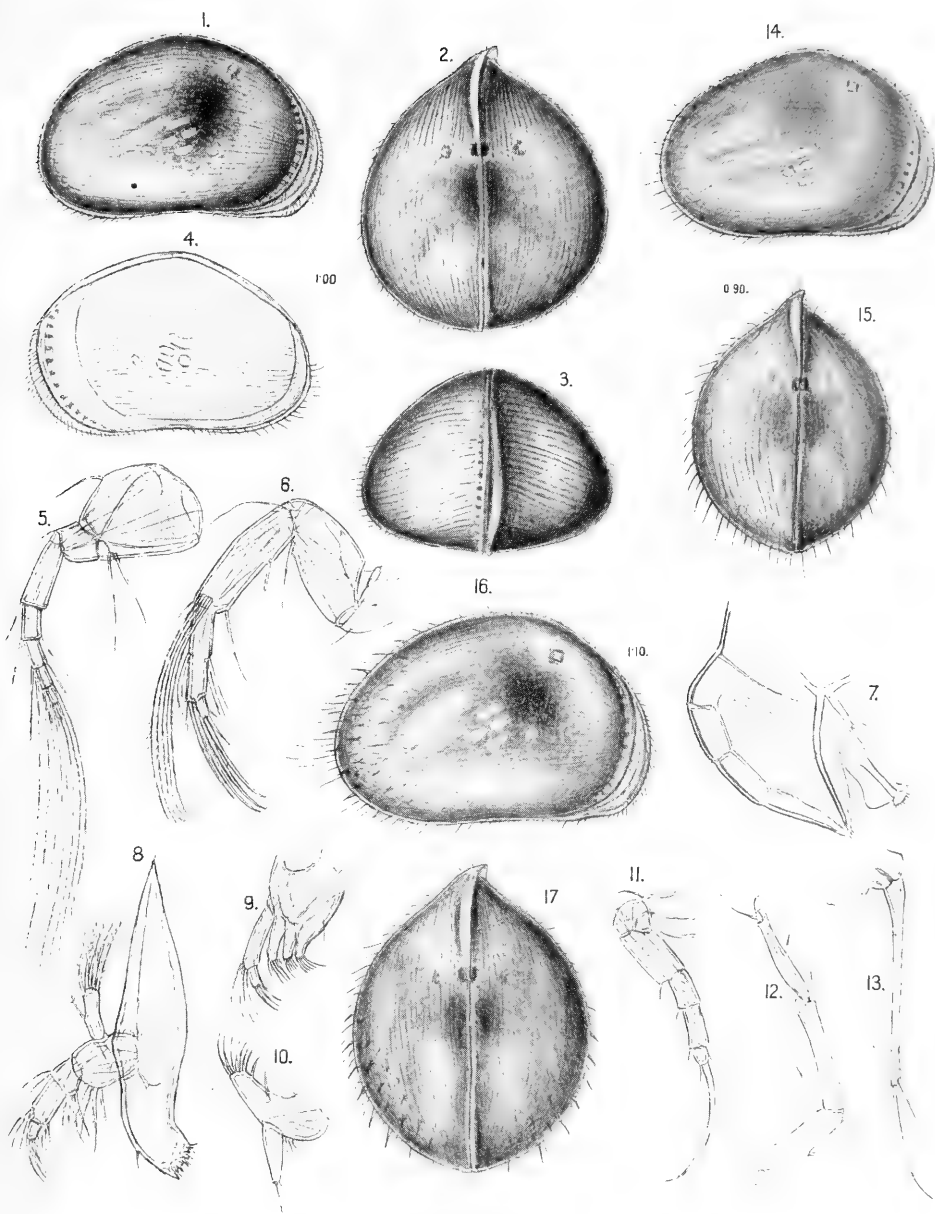


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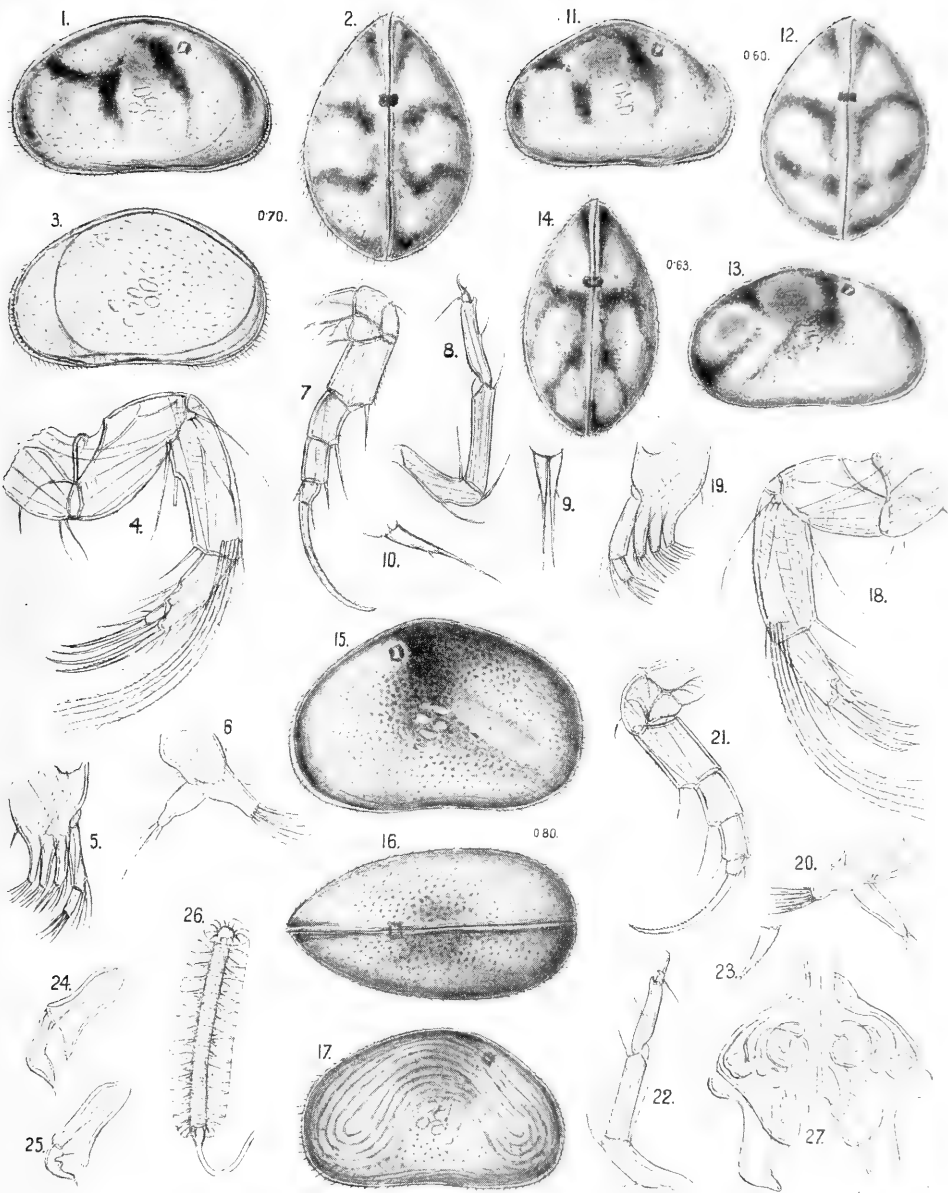


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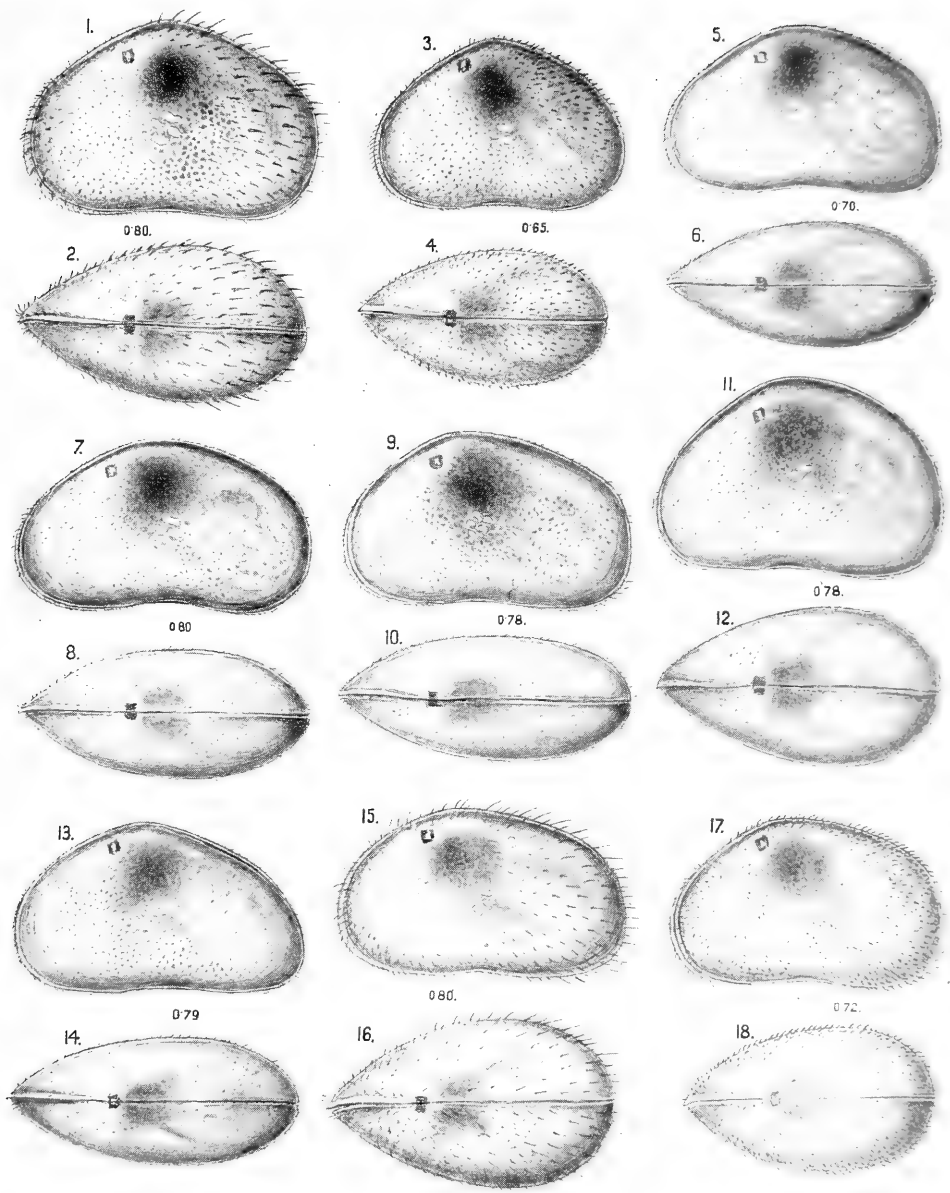
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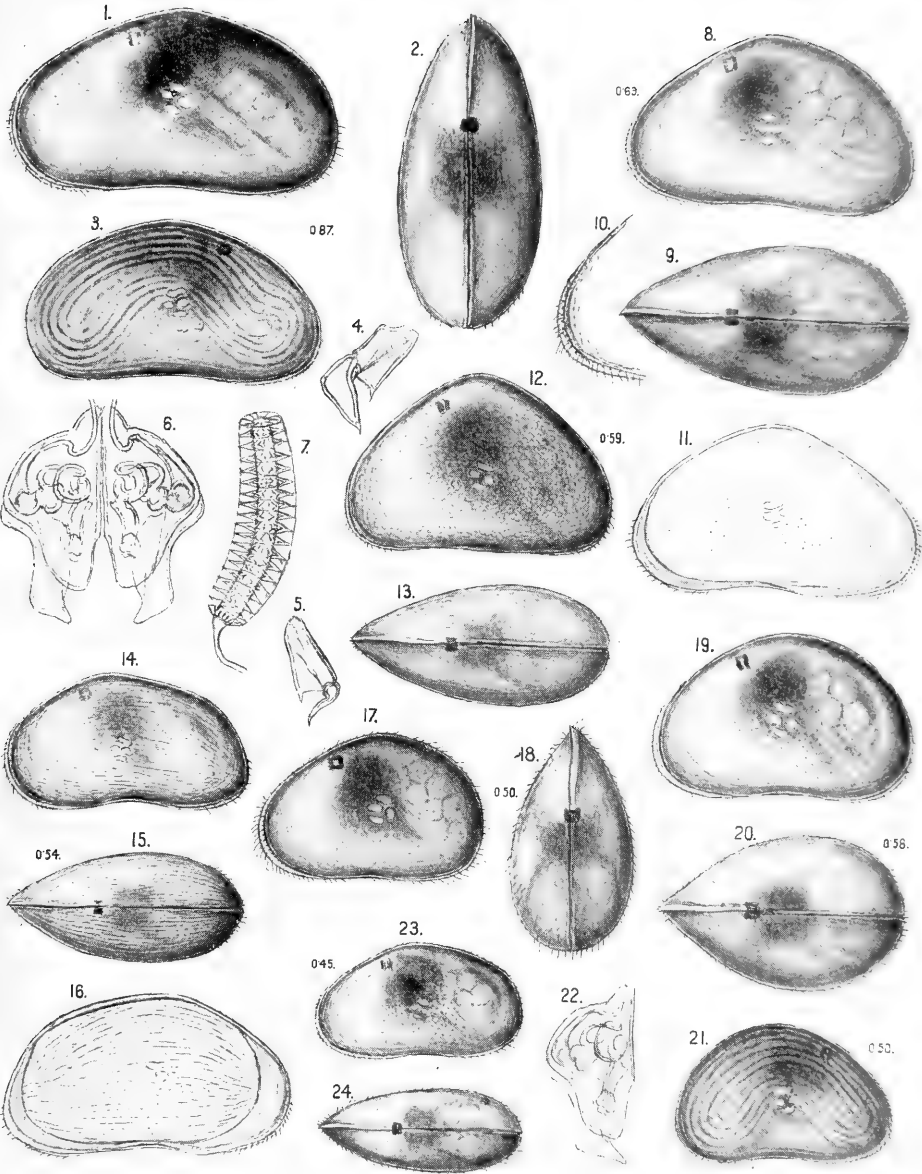
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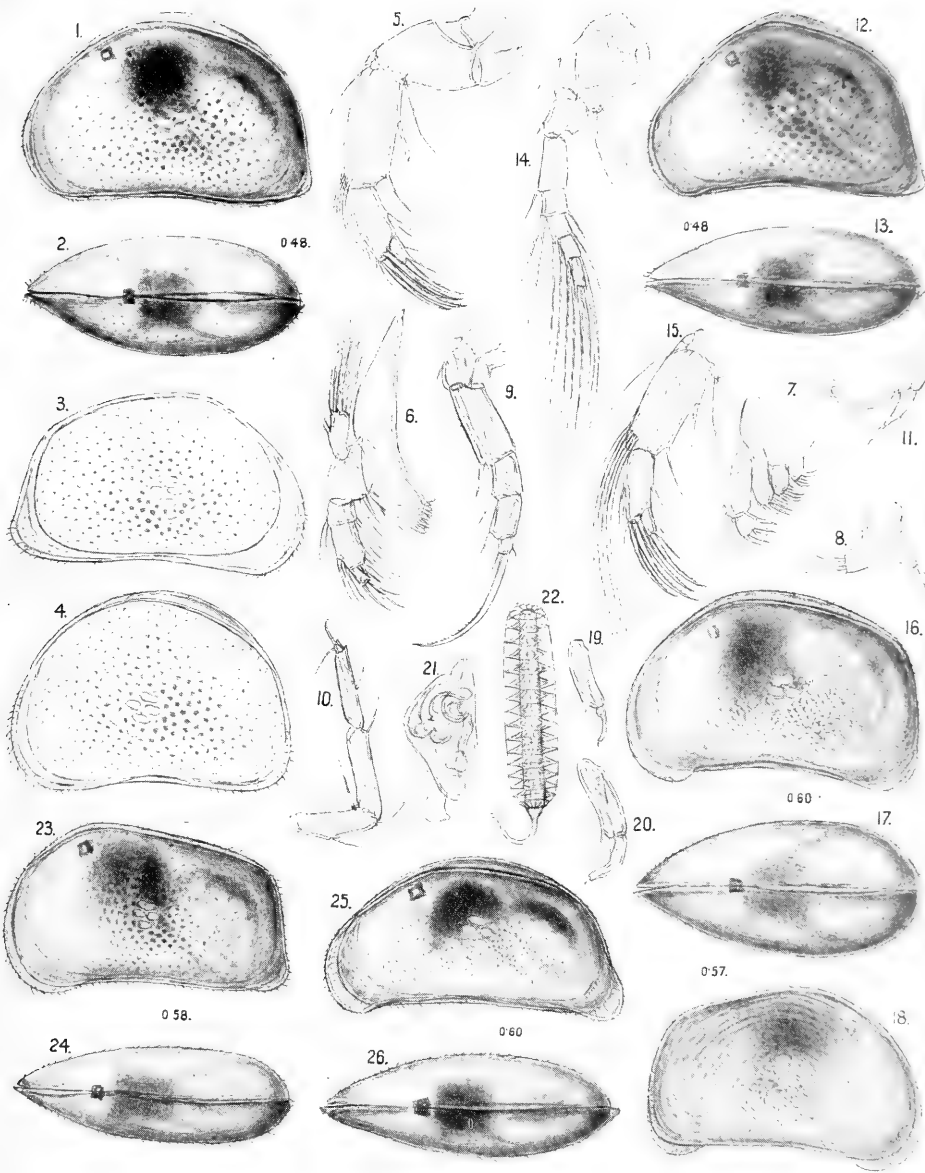
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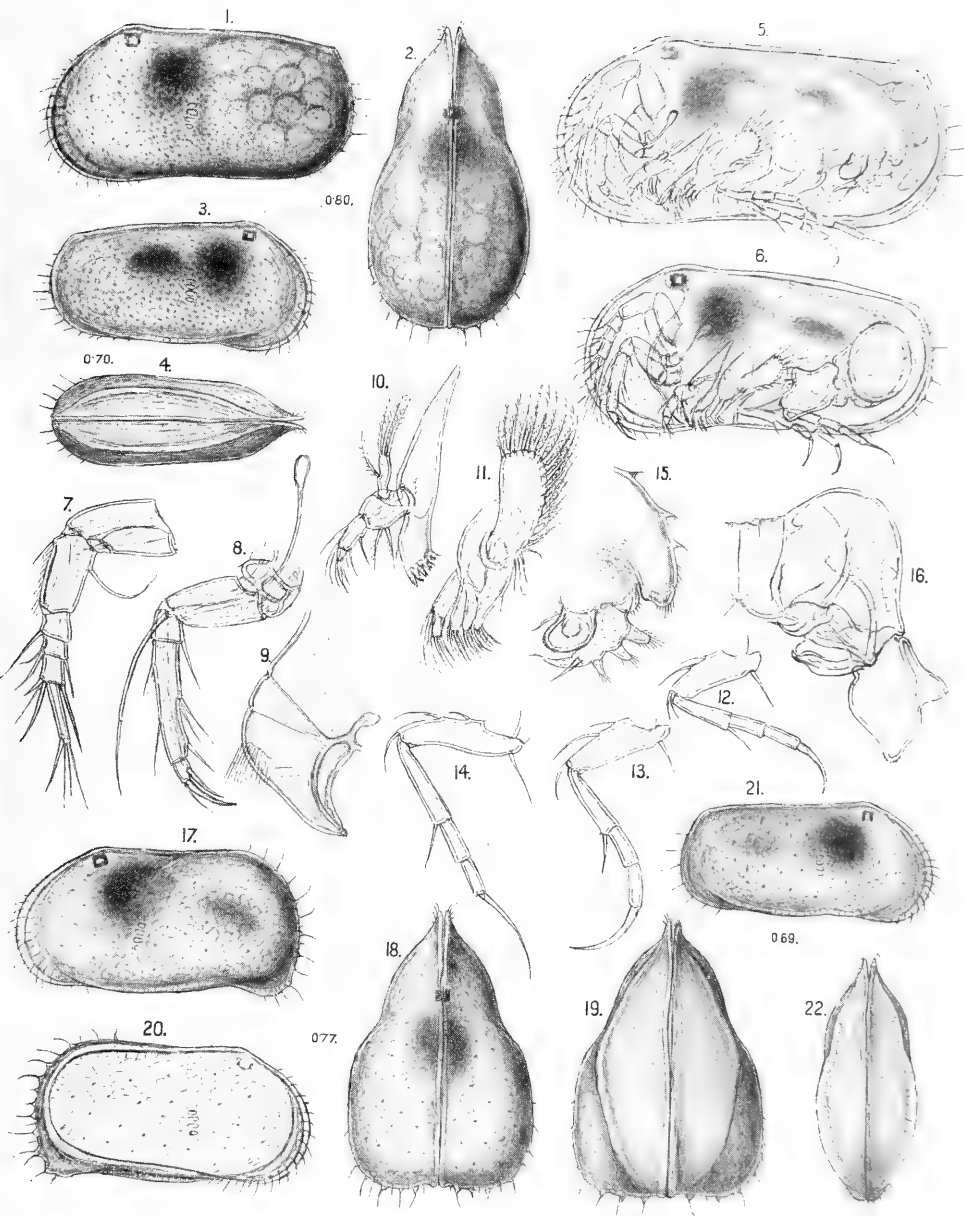
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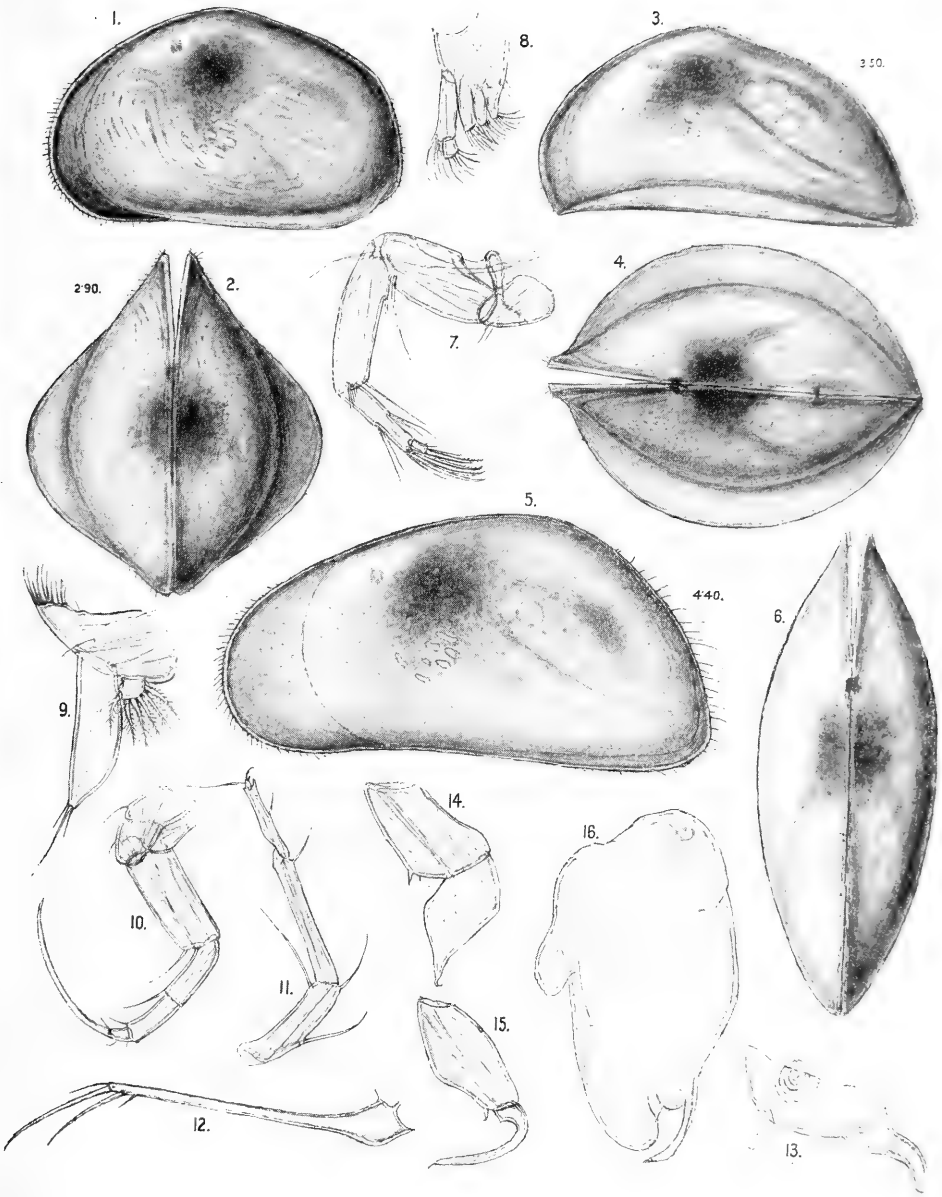
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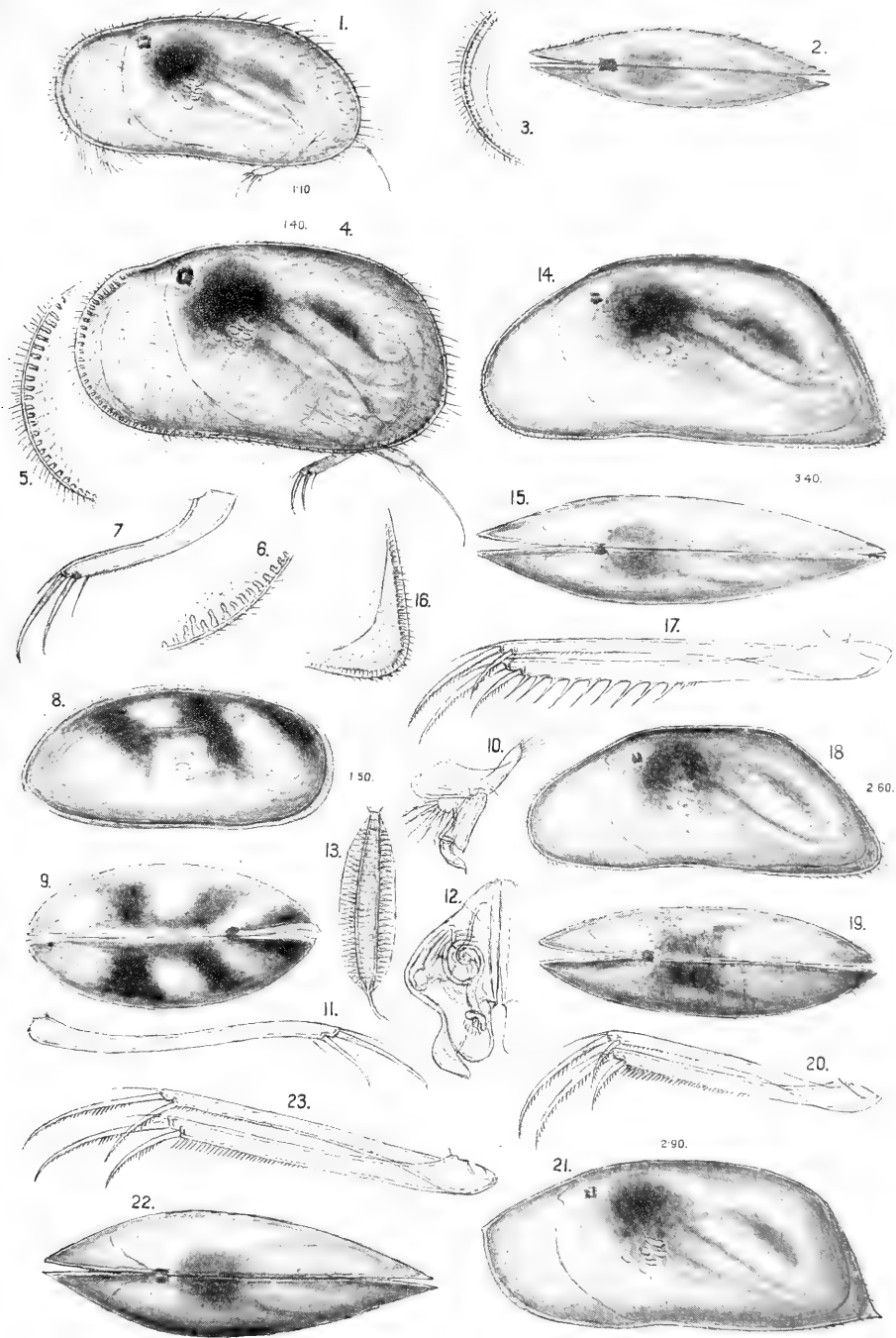
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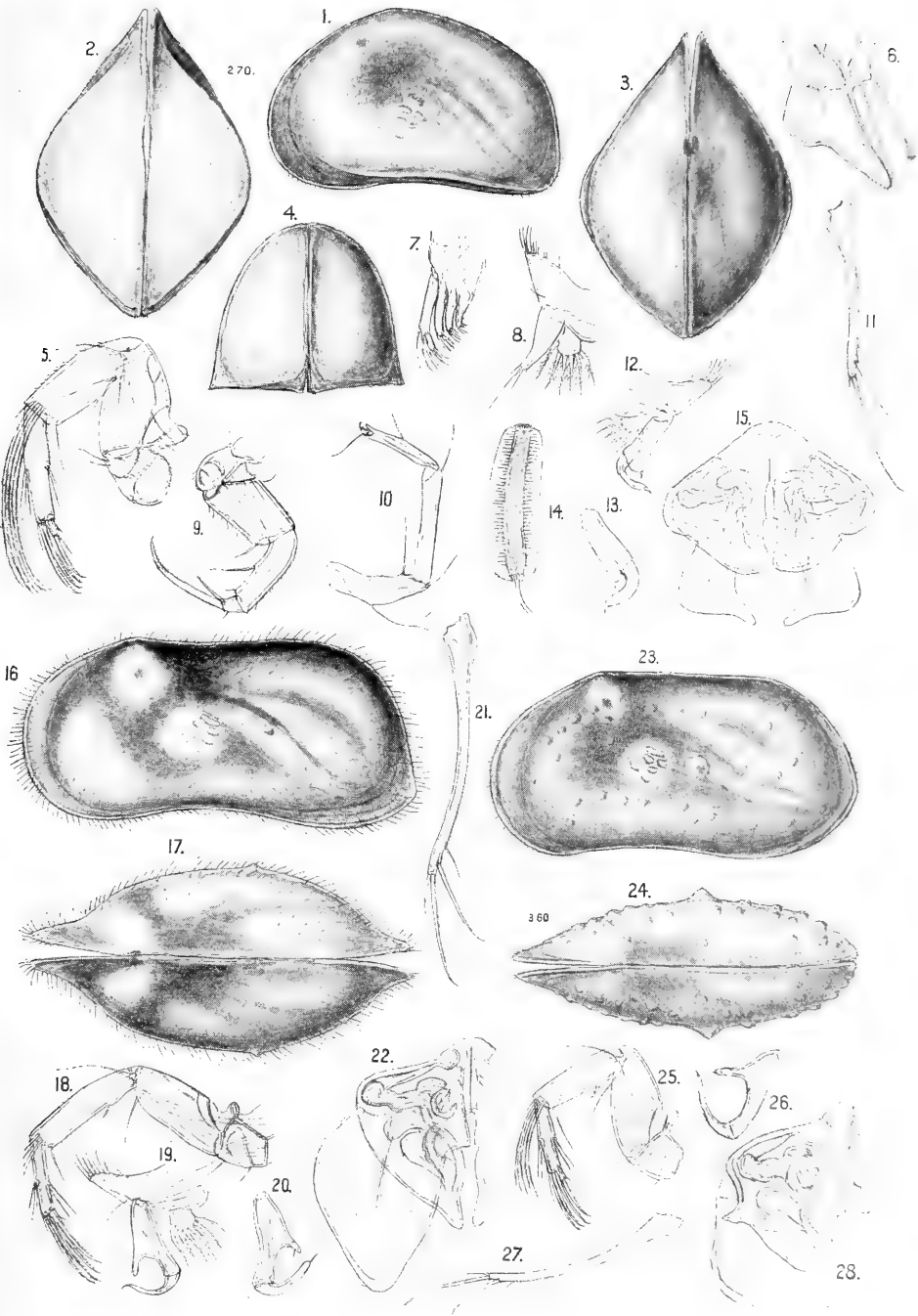


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ANNALS

OF THE

SOUTH AFRICAN MUSEUM

VOLUME XX.

PART III, containing:—

- 3.—*Contributions to a Knowledge of the Fauna of South-West Africa. I: Crustacea Entomostraca, Ostracoda.* By G. O. SARS. (Plates XXI-XXV.)
- 4.—*Contributions to a Knowledge of the Fauna of South-West Africa. II: Crustacea Entomostraca, Phyllopoda.* By K. H. BARNARD, M.A., F.L.S., F.R.S.S.Afr., Assistant Director. (Plate XXVI.)
- 5.—*Contributions to a Knowledge of the Fauna of South-West Africa. III: Crustacea Isopoda Terrestria.* By K. H. BARNARD, M.A., F.L.S., F.R.S.S.Afr., Assistant Director. (With four Text-figures.)



ISSUED NOVEMBER 1924. PRICE 4s.

PRINTED FOR THE
TRUSTEES OF THE SOUTH AFRICAN MUSEUM

BY NEILL AND CO., LTD.,
212 CAUSEWAYSIDE, EDINBURGH.

3. *Contributions to a Knowledge of the Fauna of South-West Africa.*

I: Crustacea Entomostraca, Ostracoda.—By G. O. SARRS.

(With Plates XXI-XXV.)

[UNDER the above title it is proposed to issue the results of the Zoological Survey of South-West Africa undertaken by the South African Museum in conjunction with the Administration of South-West Africa. The papers will be published from time to time as the reports on the different groups come to hand.

Although a considerable amount of work was done under the German Government, which is being gradually published (Beitr. Kenntn. Land-Süsswasser-fauna Süd-w. Afr., Hamburg), the northern parts of the region were very little explored. Therefore the main objective of the present survey was to investigate the fauna of the northern parts, especially Ovamboland and the country along the southern bank of the Kunene River. The results, as shown for example by the following paper, have amply justified the decision of the South-West Africa Administration to undertake the survey; although so large a proportion of undescribed species must not be expected in every group of animals.

For purposes of convenience in faunistic comparisons the country, as defined politically, has been divided into districts. The limits of these districts are admittedly somewhat arbitrary and vague, but the delimited areas correspond roughly with the topography and also with the botanical districts. They are as follows: (Great) *Namaqualand*, from the Orange River to about latitude 23° S.; *Damaraland*, from about 23° S. to a line running roughly from Franzfontein to Namutoni on the Etosha Pan; *Ovamboland*, the sandy flat country stretching from the Etosha Pan to the Portuguese border and from the Okavango River on the east to the mountainous country on the west called the *Kaokoveld*, which lies between Franzfontein and the Kunene River; *Namib*, the sand-dune belt which stretches along the coast between the mouths of the Orange and Kunene Rivers.—EDITOR.]

INTRODUCTORY.

The material which forms the basis of this paper was received from the South African Museum and is composed of three collections, all obtained in South-West Africa: (1) a small collection made by the late Mr. R. M. Lightfoot in 1919; (2 and 3) two collections made by Mr. K. H. Barnard in the course of two expeditions through that region in 1921 and 1923.

This region has been very little explored as regards the Entomotraca. Of the 12 species here described, only one was previously known. The only other paper dealing with species from this region is that of Daday in Schultze, *Forsch. Reise Südafrik.*, vol. ii, p. 89, 1913.

Daday records the following species:—

Herpetocypris schultzei, Dad. Between Bersheba and Bethany.

Candonocypris nama, Dad. From the same locality.

Cypridopsis viduella G. O. Sars. From Chamis, N. of Bethany, and near Salem, E. of Swakopmund. (This species is also recorded from Little Namaqualand and Knysna.)

The total number of species recorded from South-West Africa is therefore 15.

Gen. PSEUDOCYPRIS Daday, 1910.

Pseudocypris gibbera n. sp.

(Plate XXI, figs. 1–10 (♀). Plate XXII, figs. 1–7 (♂).)

Specific Characters—Female.—Shell rather tumid, seen laterally, rounded, trigonal in outline, greatest height exceeding $\frac{2}{3}$ of the length, dorsal margin boldly arched, forming in the middle an abrupt, almost gibberiform prominence, ventral margin scarcely at all sinuate, both extremities rounded; seen dorsally, broadly oval, with the greatest width about equalling $\frac{2}{3}$ of the length. Valves a little unequal, the left one slightly overlapping the right anteriorly, as also dorsally, anterior edge armed with small closely-set denticles; inner duplicatures very strongly marked, though not particularly broad. Surface of shell densely granular and clothed with rather short and delicate hairs. Structure of the several appendages closely agreeing with that in the type species.

Length of adult female 2.20 mm.

Remarks.—On a renewed examination of the rich material of this form I have been led to the conclusion that it ought to be referred more properly to the genus *Pseudocypris* than to *Cypris*, in spite of the want of a true lateral carina on the shell. Yet the characteristic

ventral aplanation of the shell is well marked and best seen in the frontal view. Among the specimens several adult males were found, and the examination of them has still further convinced me of the near relationship of the present form to the other members of the genus *Pseudocypris*. Thus the very characteristic arrangement of the spermatic vessels is the very same as that mentioned by Daday in the type species, these vessels not being, as usual, confined to the posterior part of the valves, but running forward along the ventral face and terminating in a well-marked and rather ample coil within the anterior part of each valve. It was, indeed, on this character that Daday chiefly based his genus. The structure of the prehensile palps of the maxillipeds, the copulatory appendages, and the ejaculatory tubes are also built on the very same type as in the other species of this genus, only exhibiting some minor specific differences.

Occurrence.—Two females of this form were taken at Otjituo, Damaraland, by the late Mr. Lightfoot; and Mr. Barnard found it very abundantly at seven different places in Ovamboland, viz. Onambeke, Onolongo, Tamansu, Ukualuthi, Ukualonkathi, Eunda. The colour of the specimens in the living state was noted to be greenish.

Pseudocypris circularis n. sp.

(Plate XXII, figs. 8–12.)

Specific Characters—Female.—Shell provided below with a well-marked lamellar carina encircling it almost entirely; seen laterally, irregularly oval triangular in shape, greatest height about in the middle and considerably exceeding half the length, dorsal margin gibbously arched in the middle and somewhat abruptly bent behind, ventral margin perfectly straight, anterior extremity obliquely rounded, posterior produced below to an obtuse point; seen dorsally, almost circular in outline, the lateral crest being quite evenly curved and only somewhat interrupted in front by the slightly projecting anterior extremity of the shell. Surface of valves smooth, without any pronounced sculpture and very finely hairy at each extremity. Structure of the limbs closely agreeing with that in the other species of the genus. Caudal rami very narrow, linear.

Length of adult female 2.40 mm.

Male unknown.

Remarks.—This is a genuine member of the genus *Pseudocypris*, agreeing in its general appearance very closely with the type species *P. bouvieri*, described by Daday. It is, however, of much larger size,

and differs somewhat in the shape of the shell, as seen laterally. The caudal rami are also considerably more slender than figured by Daday in his species.

Occurrence.—Some few female specimens of this form, one of them fully grown, were taken by Mr. Barnard at Onambeke, Ovamboland.

Gen. SCLEROCYPRIS G. O. Sars.

Sclerocypris exserta n. sp.

(Plate XXII, figs. 13–18, and Plate XXIII, figs. 1–3.)

Specific Characters.—*Female*.—Shell, seen laterally, oblong clavate in outline, greatest height quite in front and scarcely attaining half the length, dorsal margin angularly bent in the ocular region and sloping gently behind, ventral margin nearly straight, anterior extremity broadly rounded, posterior obliquely truncated and produced below to a rather conspicuous somewhat upturned corner; seen dorsally, narrow fusiform, with the greatest width scarcely exceeding $\frac{1}{3}$ the length, both extremities obtusely pointed. Valves of rather firm consistency and nearly equal, posterior corner of left valve however somewhat more prominent than that of the right; inner duplicatures of anterior extremity very strongly marked off inside, marginal zone rather broad and finely striated transversally. Surface of shell sculptured with well-marked closely-set pits and clothed with comparatively short and delicate hairs. Caudal rami very narrow, linear, and quite straight, apical claws thin, almost setiform, the larger one scarcely attaining half the length of the ramus.

Length of adult female 2.90 mm.

Remarks.—The above-described form is closely allied to the type species *S. clavularis* G. O. Sars, but has the shell somewhat more elongated and the posterior corner considerably more prominent. The specific name here proposed alludes to this latter character.

The *male* resembles the female both in size and in the general shape of the shell, but may easily be detected by the more or less distinctly translucent spermathecal vessels. The arrangement of these vessels is quite normal. The prehensile palps of the maxillipeds are conspicuously unequal, that of the right being as usual the larger, with the thumb-like process of the propodus acutely produced and issuing from about the middle, whereas in the left this process is more digitiform and placed much nearer the end of the propodus. The copulatory appendages also are somewhat different in shape from those in the type species. In quite young specimens of the present form

the free edges of both valves are densely fringed with slender spinules, all of them of the same appearance and terminating in an obtuse point. A rather similar armature has been described by Vávra in immature specimens of his *Cypris venusta*, which unquestionably is referable to the present genus; but the spinules of the anterior edges are in that species of a different kind, being digitate, whereas in the present species they are quite simple.

Occurrence.—This form was taken by Mr. Barnard very abundantly in seven different places in Ovamboland, viz. Ondongua, Ukualuthi, Ukualonkathi, Eunda, Onolongo, Onambeke, Andoni. The colour of the living animal was greenish.

Sclerocypris major n. sp.

(Plate XXII, figs. 19–22, and Plate XXIII, figs. 4–6.)

Specific Characters—Female.—Shell, seen laterally, broadly suboval in outline, greatest height about in the middle and considerably exceeding half the length, dorsal margin slightly angular in the ocular region, but forming otherwise a rather even curve, without any abrupt bend behind, ventral margin scarcely at all sinuate, anterior extremity broadly rounded, with trace of an angle below, posterior gradually narrowed and drawn out to a slightly projecting corner; seen dorsally, oblong fusiform, with the greatest width somewhat exceeding $\frac{1}{3}$ the length, anterior extremity more tapered than the posterior. Valves slightly unequal, the left one overlapping the right somewhat dorsally, as also along the anterior extremity. Inner duplicatures and sculpture of the shell as in the preceding species. Caudal rami likewise rather similar, though having the dorsal edge finely spinulose.

Length of adult female 3.30 mm.

Male.—In the structure of the sexual appendages well-marked specific differences from those in the other two species are found. The prehensile palps of the maxillipeds are also in this species conspicuously unequal; but the inequality is displayed in a rather different manner from that in the preceding species, as seen from the figures. In the right palp the propodus is very coarse and somewhat curved, with the thumb-like process comparatively short and bidentate at the tip, whereas in the left palp this process is simple and issues nearly in the middle of the propodus. The copulatory appendages are especially distinguished by the peculiar shape of the inner terminal lobe, which is abruptly inflexed and terminates in a sharp corner.

Remarks.—Though differing rather conspicuously from the preceding species in the general shape of the shell, the present form is unquestionably congeneric with it, agreeing as it does fairly well in all essential structural details. It is of considerably larger size than either of the other two species.

Occurrence.—This form was taken at four localities in Ovamboland by Mr. Barnard: Onolongo, Tamansu, Eunda, Ukualuthi, and at Tsumeb in Damaraland.

Sclerocypris superba n. sp.

(Plate XXIV, figs. 1-5.)

Specific Characters—*Female.*—Shell moderately tumid, seen laterally, strongly vaulted, irregularly trigonal in shape, with the greatest height equalling about $\frac{3}{8}$ of the length and occurring in the middle, dorsal margin boldly arched and sloping rather steeply in front and behind, ventral margin almost straight, anterior extremity obliquely rounded, posterior tapering below to a narrowly rounded corner; seen dorsally, oval fusiform in outline, with the greatest width nearly equal to half the length, both extremities somewhat produced and pointed. Valves with the inner duplicatures of somewhat simpler structure than in the other species, surface smooth, without any pronounced sculpture, and minutely hairy. Structure of the several limbs on the whole agreeing with that in the other species. Caudal rami very slender and narrow, with the dorsal edge minutely spinulose in its outermost part, claws almost straight and slightly unequal, the distal one about equalling half the length of the ramus.

Male resembling closely the female both in size and in shape of the shell. Prehensile palps of the maxillipeds nearly perfectly alike, both having the thumb-like process of the propodus issuing from about the middle, dactylus very slender and abruptly bent at the base. Copulatory appendages with the inner lobe imperfectly developed, outer lobe broadly rounded.

Colour of living specimens greenish.

Length of adult female amounting to 4 mm.

Remarks.—This fine Ostracod may at once be distinguished from the other species of this genus by its large size and highly vaulted shell. In the structure of the male sexual appendages it also differs conspicuously, though being unquestionably referable to the same genus.

Occurrence.—Some well-preserved specimens of this pretty species

are in the collection, having been taken by Mr. Barnard at Andoni and Eunda in Ovamboland.

Gen. *HERPETOCYPRIS* Claus, 1892.

Herpetocypris oblonga n. sp.

(Plate XXI, figs. 11-14.)

Specific Characters.—*Female*.—Shell, seen laterally, of a rather regular oblong or ellipsoid shape, greatest height somewhat behind the middle and scarcely exceeding half the length, dorsal margin quite evenly arched throughout, ventral margin slightly sinuate in the middle, anterior extremity somewhat deflexed, posterior obtusely produced; seen dorsally, oblong oval in outline, with the greatest width not attaining half the length, anterior extremity slightly produced, posterior obtuse. Valves conspicuously unequal, anterior margin of the left projecting considerably beyond that of the right and forming below an angular corner, right valve distinctly denticulated along the posterior part of the ventral edge, but without any obvious denticles on the anterior edge. Surface of shell smooth and polished with no distinctly marked sculpture and finely hairy in front and behind. Caudal rami moderately slender and slightly curved, dorsal edge smooth, apical claws comparatively stout, the larger one scarcely exceeding half the length of the ramus.

Length of adult female 1.30 mm.

Remarks.—The above-described form is evidently referable to the genus *Herpetocypris* Claus, though differing conspicuously from the other known species in the more elongated shape of the shell, and more particularly in the absence of the usual denticles along the anterior edge of the right valve. Otherwise it does not, however, seem to exhibit any essential structural difference.

Occurrence.—Two female specimens of this form were collected by the late Mr. Lightfoot at Otjituo in Damaraland.

Herpetocypris ovularis n. sp.

(Plate XXIV, figs. 6-13.)

Specific Characters.—*Female*.—Shell, seen laterally, of a rather regular oval shape, greatest height about in the middle and not attaining half the length, dorsal margin evenly arched behind and somewhat flattened in the ocular region, ventral margin very slightly

sinuate in the middle, both extremities quite evenly and obtusely rounded, and nearly equal; seen dorsally, oblong ovate in outline with the greatest width somewhat behind the middle and about equal to half the length, anterior extremity more narrowed than the posterior, though somewhat blunted at the tip. Valves as in the other species of the present genus rather unequal, the left overlapping the right conspicuously along the anterior extremity of the shell, free edges of right valve armed in almost their whole extent with small knob-like tubercles, which, however, only slightly project beyond the margin. Surface of shell smooth and polished, with only slight traces of hairs. Structure of the several limbs nearly as in the other species. Caudal rami, however, unusually slender and narrow.

Male of somewhat smaller size than female, but resembling it rather closely in the shape of the shell. Prehensile palps of the maxillipeds as in the other species, somewhat unequal, the dactylus of the right being considerably broader and more laminar than that of the left, thumb-like process of propodus in both palps replaced by a slight dentiform prominence close to the end. Copulatory appendages with the outer lobe considerably produced and narrow falciform in shape. Ejaculatory tubes of moderate size and agreeing in structure with those of the other species.

Length of adult female 1.80 mm.

Remarks.—The above-described form may be easily recognised by the regularly oval shape of the shell as seen laterally, both extremities being quite evenly and uniformly rounded. Of the structural details the unusually slender and narrow form of the caudal rami may be mentioned as distinctive.

Occurrence.—Several specimens of this form were taken by Mr. Barnard at Ukualuthi and Ongka in Ovamboland.

Gen. STENOCYPRIS G. O. Sars, 1889.

Stenocypris fascigera n. sp.

(Plate XXIV, figs. 14–19.)

Specific Characters.—*Female.*—Shell much compressed, seen laterally oblong oval in shape, greatest height about in the middle and not nearly attaining half the length, dorsal margin only slightly arched and abruptly deflexed behind, ventral margin almost straight, anterior extremity broadly rounded, posterior produced below to a more or less prominent corner narrowly obtuse at the tip; seen dorsally

very narrow lanceolate in shape, with the greatest width in front of the middle and scarcely attaining $\frac{1}{4}$ of the length, posterior extremity gradually attenuated. Valves rather thin and nearly equal, with a narrow closely striated marginal rim, inner duplicatures in front as usual very broad. Surface of shell smooth and minutely hairy. Structure of the several appendages scarcely different from that in the other species of the genus. Caudal rami rather elongated and as in the other species conspicuously asymmetrical, the right being much narrower than the left, which, moreover, has the dorsal edge armed with coarse spinules; these spinules are, however, in the present species arranged in quite a peculiar manner, viz. in eight successive and sharply defined fascicles, each fascicle containing a somewhat varying number of spinules gradually increasing in length distally.

Male resembling the female in general shape of shell, but of somewhat smaller size. Prehensile palps of the maxillipeds nearly perfectly equal, propodus of both gradually dilated distally and without any distinctly defined thumb-like process, dactylus comparatively thick and obtuse at the tip. Copulatory appendages not very large and somewhat lamellar, with the terminal lobes obtuse and closely superposed. Ejaculatory tubes rather slender and subfusiform in shape, with the proximal extremity drawn out to a knob-like prominence.

Colour of living specimens greenish.

Length of adult female 3.10 mm.

Remarks.—The present species somewhat resembles in the general shape of the shell that described by me as *S. pectinata* (these *Annals*, vol. xx, p. 129). It is, however, distinguished both from this and any other species known to me by the peculiar arrangement of the spinules on the dorsal edge of the left caudal ramus, a character which has suggested the specific name.

Occurrence.—Several specimens of this form were taken by Mr. Barnard at Onolongo, Ukualuthi and Eunda in Ovamboland. Some of them have the posterior corner of the shell somewhat less prominent than in the figure here given, but not differing in any other respect.

Gen. MEGALOCYPRIS G. O. Sars, 1898.

Megalocypris brevis n. sp.

(Plate XXI, figs. 15–22.)

Specific Characters.—*Female*.—Shell shorter and stouter than in any of the other species, seen laterally broadly oval or somewhat

quadrangular in outline, with the greatest height considerably exceeding half the length, dorsal margin straight in the middle, slightly angular in front and rather abruptly curved behind, ventral margin only slightly sinuate, both extremities somewhat obliquely deflexed, the anterior rounded, the posterior rather broader and terminating below in a blunt corner; seen dorsally oblong oval, with the greatest width not attaining half the length, both extremities gradually contracted. Surface of shell finely granular but without any tubercles, and clothed with very short and delicate hairs, posterior corner of each valve finely denticulate below. Natatory seta of posterior antennae much reduced in size. Caudal rami of the usual slender shape and distinctly curved in their outer part, dorsal edge very finely spinulose, apical claws not very unequal, the larger about equalling in length half the ramus.

Male resembling the female in size and shape of shell. Prehensile palps of maxillipeds with the thumb-like process comparatively small and issuing about in the middle of the hand, dactylus rather slender. Copulatory appendages with the outer lamella not very large, linguiform, incurved. Ejaculatory tubes comparatively short, with numerous densely crowded chitinous whorls.

Colour (as preserved) yellowish grey, variegated with irregular partly confluent dark patches.

Length of adult female 2.90 mm.

Remarks.—The above-described form is unquestionably referable to the genus *Megalocypris*, though in size it is rather inferior to the other species of this genus. It may also be easily distinguished from them by the short and stout shape of the shell, a character which indeed has given rise to the specific name here proposed. Moreover, some well-marked differences are found in the shape of the prehensile palps of the maxillipeds and the copulatory appendages in the male.

Occurrence.—Some few well-preserved specimens of this form are in the material collected by Mr. Barnard at Namutoni.

Gen. CYPRIDOPSIS Brady, 1866.

Cypridopsis aldabrae G. W. Müller.

(Plate XXIII, figs. 7–12.)

Cypridopsis aldabrae G. W. Müller, Ostrac. v. Madagasc. u. Ostaf., Senck. nat. Gesell., Bd. xxi, Hft. 2, p. 381, Taf. 18, figs. 1–14.

Specific Characters—Female.—Shell, seen laterally, oblong trigonal, or somewhat reniform, greatest height a little in front of the middle

and about equalling $\frac{3}{5}$ of the length, dorsal margin boldly arched, ventral margin distinctly sinuate, both extremities slightly deflexed, the anterior obliquely rounded, the posterior a little narrower and obtusely blunted; seen dorsally, oblong oval in shape, with the greatest width about equalling half the length. Valves rather thin and unequal, the right overlapping the left somewhat along the anterior extremity. Surface of shell without any distinctly marked sculpture but everywhere clothed with rather strong recurved hairs.

Male somewhat smaller than the female, but resembling it in shape. Prehensile palps of maxillipeds very unequal, that of the left with the hand long and slender, exhibiting in the middle of the inner edge two juxtaposed short setae attached to a slightly prominent nodule, dactylus abruptly curved and narrowly produced at the end; that of the right much more powerfully developed, with both the hand and the dactylus much broader, the latter falciformly curved. Copulatory appendages with the outer lamella narrow digitiform and, unlike what is generally the case, abruptly bent outwards, inner lamella comparatively small. Ejaculatory tubes rather narrow, with about sixteen strongly marked chitinous whorls.

Colour not yet ascertained.

Length of adult female 0.90 mm.

Remarks.—No doubt can arise about the identity of the above-described form with that recorded by G. W. Müller. It is a well-defined species, being particularly distinguished by the peculiar shape of the prehensile palps and the copulatory appendages in the male.

Occurrence.—Several specimens of this form were collected by the late Mr. Lightfoot at Otjituo. G. W. Müller's specimens came from Aldabra in East Africa.

Cypridopsis punctata n. sp.

(Plate XXIII, figs. 13–15.)

Specific Characters—Female.—Shell, seen laterally, oval subtrigonal in outline, greatest height in the middle and about equalling $\frac{3}{5}$ of the length, dorsal margin gibbously arched, ventral margin distinctly sinuate, anterior extremity narrowly rounded, posterior obtusely blunted; seen dorsally, ovoid in shape, with the greatest width about half the length, more pointed in front than behind. Surface of shell densely granular, being sculptured with very small closely-set pits, and clothed with comparatively short and delicate hairs.

Colour not yet ascertained.

Length of adult female 0.70 mm.

Male unknown.

Remarks.—The present form somewhat resembles in its general appearance *C. gregaria* G. O. Sars, but has the dorsal profile of the shell less elevated, and is, moreover, at once distinguished by the rather different sculpture of the valves, which latter characteristic has given rise to the specific name.

Occurrence.—Some few female specimens of this form were collected by the late Mr. Lightfoot at Otjituo.

AFROCYPRIS g. n.

Generic Characters.—Shell elongate, resembling in shape somewhat that of *Herpetocypris*, but with the valves subequal and the inner duplicatures much narrower. Antennae well adapted for swimming, the natatory setae of the posterior ones being distinctly ciliated, though not much prolonged. Maxillipeds of normal structure. Maxillae with the masticatory lobes rather stout, palps, however, comparatively slender, with the distal joint slightly longer than it is broad. Palps of maxillipeds in female quite normal, in male very powerfully developed and conspicuously unequal, with no distinctly defined thumb-like process on the propodus. Legs similar in structure to those in *Herpetocypris*. Caudal rami very slender and elongated; without any armature on the dorsal edge. Genital lobes of female of rather peculiar structure. Copulatory appendages of male likewise rather different in shape from those of most other *Cypridae*. Ejaculatory tubes of quite an unusual size, with both extremities pronouncedly cup-shaped, radiating spikes very numerous and densely crowded.

Remarks.—This new genus is established to include a large Ostracod which I have been unable to refer to any of the known genera of the *Cypridae*, though it shows some affinity on the one hand to *Eucypris*, on the other to *Megalocypris*. The genital apparatus especially is rather peculiar and unlike that of any genus known to me.

Afrocypris barnardi n. sp.

(Plate XXV.)

Specific Characters—*Female*.—Shell rather tumid, seen laterally oblong reniform in shape, greatest height about in the middle and not

nearly attaining half the length, dorsal margin almost straight in the middle and sloping at a uniform rate both in front and behind, ventral margin scarcely at all sinuate, both extremities obtusely rounded, the anterior somewhat broader than the posterior; seen dorsally, oblong ovate in outline, greatest width in the middle and about equal to the height, both extremities gradually attenuated. Valves rather thin and pellucid, with a narrow closely striated marginal rim, running at a short distance inside the marginal one. Surface of shell smooth and glabrous, without any obvious sculpture and minutely hairy at each extremity. Anterior antennae with the first joint of the terminal part fully as long as the remaining four joints combined, setae rather slender and elongated. Posterior antennae with the terminal part much attenuated, apical claws nearly straight and distinctly denticulate, natatory setae extending about to the middle of the claws. Caudal rami exceedingly narrow and elongated and almost straight, with the dorsal edge quite smooth, apical claws of rather unequal size, the distal one being almost twice as long as the proximal one, but not nearly attaining half the length of the ramus, dorsal seta close to the end. Genital lobes produced behind to a rather prominent lanceolate lappet, and having anteriorly a peculiar digitiform deflexed appendage, in front of which a group of delicate papillae occur, which apparently surround the genital aperture leading to the seminal receptacle.

Male of about the same size as female and resembling it closely in shape of shell. Prehensile palp of right maxilliped exceedingly large, with the propodus much expanded and triangular in shape forming at the end inside a projecting corner replacing the thumb-like process in other Ostracods; dactylus very powerfully developed, with the inner edge conspicuously convex in the middle. Left palp of maxilliped rather different in appearance, the propodus being simply oval in shape, and the dactylus much feebler and narrowly produced. In immature male specimens the propodus and dactylus are wholly confluent, and these appendages thereby acquire a perplexing similarity to the palps in adult males of the genus *Candona*. Copulatory appendages of considerable size, with the inner lobe very fully developed and conically produced behind, terminating in two small lobules, outer lobe represented by a thin rounded lamella. Ejaculatory tubes extending along the greater part of the body and easily observable through the pellucid shell. The thread-like spermatozoids are seen accumulated in dense clusters within the posterior part of the body and may be gradually sucked up by the ejaculatory tubes, running

forwards along the dorsal face of the body and congregating into two juxtaposed cylindric strings, which just behind the eye are abruptly bent downwards and backwards to join the proximal cup-shaped extremities of the ejaculatory tubes. During copulation the spermatozoids are then expelled by the muscular action of the tubes through the vas deferens into the copulatory appendages.

In living specimens the colour is whitish or cream-coloured.

Length of adult female amounting to 5.30 mm.

Remarks.—This is the largest and finest of the Ostracods collected in this region, and I have much pleasure in naming it in honour of its discoverer, Mr. K. H. Barnard, to whom we also owe the discovery of many other interesting animals. In size this form is only exceeded by the huge *Megalocypris princeps* G. O. Sars.

Occurrence.—The present handsome Ostracod was taken by Mr. Barnard at two places in Ovamboland, viz. Ukualuthi and Tamansu. Several specimens were collected at both places.

EXPLANATION OF PLATES.

PLATE XXI.

Pseudocypris gibbera n. sp.

FIG.

1. Adult female, viewed from left side.
2. Piece of anterior extremity of valve, more highly magnified, to show fine denticulation of the edge.
3. Shell seen dorsally.
4. Left valve of another specimen, viewed from inner face, showing strongly marked inner duplicature.
5. Posterior antenna.
6. Outer part of maxilla.
7. Maxilliped.
8. Anterior leg.
9. Posterior leg.
10. Caudal ramus.

Herpetocypris oblonga n. sp.

11. Adult female, viewed from right side.
12. Same, dorsal view.
13. Anterior extremity of shell, seen from right side and more strongly magnified.
14. Caudal ramus.

Megalocypris brevis n. sp.

15. Adult female, viewed from left side.
16. Same, dorsal view.
17. Posterior extremity of valve more highly magnified, showing the fine denticulations of the edge below.
18. Posterior antenna (basal part not fully drawn).
19. Left maxilliped of male.
20. Caudal ramus.
21. Right copulatory appendage.
22. Ejaculatory tube.

PLATE XXII.

Pseudocypris gibbera n. sp.

1. Male, frontal view of shell, to show its ventral aplanation.
2. Left valve, seen from inner face, showing the corresponding coecal tube of the intestine and the spermatic vessels.
3. Piece of anterior part of a valve, more highly magnified, to show the fine denticulation of the edge.
4. Prehensile palp of right maxilliped.
5. Palp of left maxilliped.
6. Left copulatory appendage with part of adjoining right appendage.
7. Ejaculatory tube.

Pseudocypris circularis n. sp.

FIG.

8. Adult female, dorsal view.
9. Left valve of same specimen seen from outer face.
10. Maxilla (without the vibratory plate).
11. Anterior leg.
12. Caudal ramus.

Sclerocypris exserta n. sp.

13. Right valve of adult male seen from inner face, showing the corresponding coecal tube of the intestine and the spermatic vessels.
14. Right maxilliped of male.
15. Palp of left maxilliped.
16. Copulatory appendage.
17. Right valve of an immature specimen seen from inner face, showing the peculiar armature of the free edge.
18. Piece of anterior part of same valve more highly magnified.

Sclerocypris major n. sp.

19. Adult male, viewed from left side.
20. Right maxilliped.
21. Palp of left maxilliped.
22. Copulatory appendage.

PLATE XXIII.

Sclerocypris exserta n. sp.

1. Adult female, viewed from right side.
2. Same, dorsal view.
3. Caudal ramus.

Sclerocypris major n. sp.

4. Adult female, viewed from right side.
5. Same, dorsal view.
6. Caudal ramus.

Cypridopsis aldabrae G. W. Müller

7. Adult female, viewed from left side.
8. Same, dorsal view.
9. Palp of right maxilliped of male.
10. Left maxilliped.
11. Copulatory appendages.
12. Ejaculatory tube.

Cypridopsis punctata n. sp.

13. Adult female, viewed from left side.
14. Same, dorsal view.
15. Caudal ramus.

PLATE XXIV.

Sclerocypris superba n. sp.

FIG.

1. Adult female, viewed from left side.
2. Same, dorsal view.
3. Maxilliped of male.
4. Copulatory appendage.
5. Caudal ramus.

Herpetocypris ovularis n. sp.

6. Adult female, viewed from right side.
7. Same, dorsal view.
8. Piece of anterior part of right valve seen from inner face, showing the arrangement of the marginal tubercles.
9. Right maxilliped of male.
10. Palp of left maxilliped.
11. Copulatory appendages.
12. Caudal ramus.
13. Ejaculatory tube.

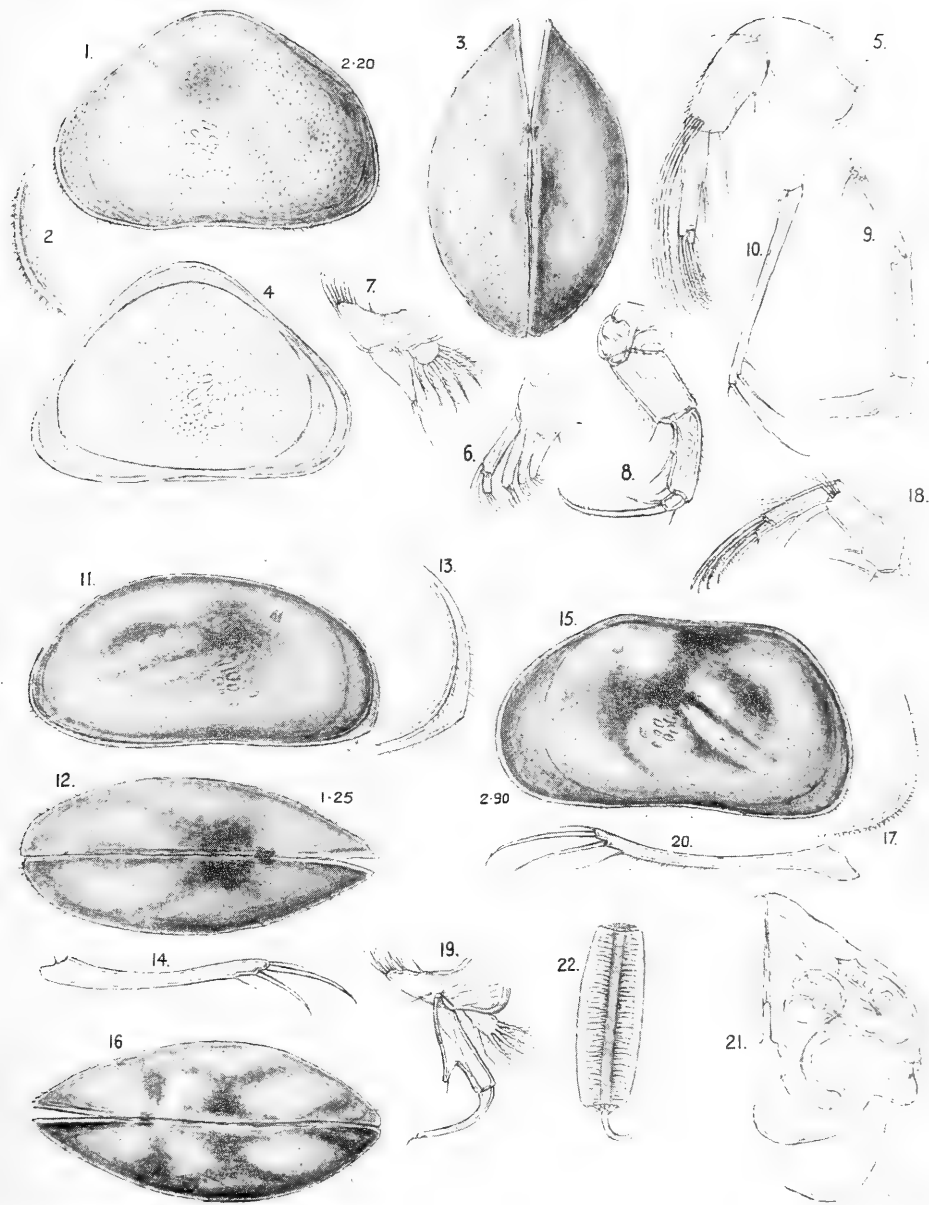
Stenocypris fascigera n. sp.

14. Adult female, viewed from left side.
15. Same, dorsal view.
16. Maxilliped of male.
17. Copulatory appendage.
18. Caudal rami.
19. Ejaculatory tube.

PLATE XXV.

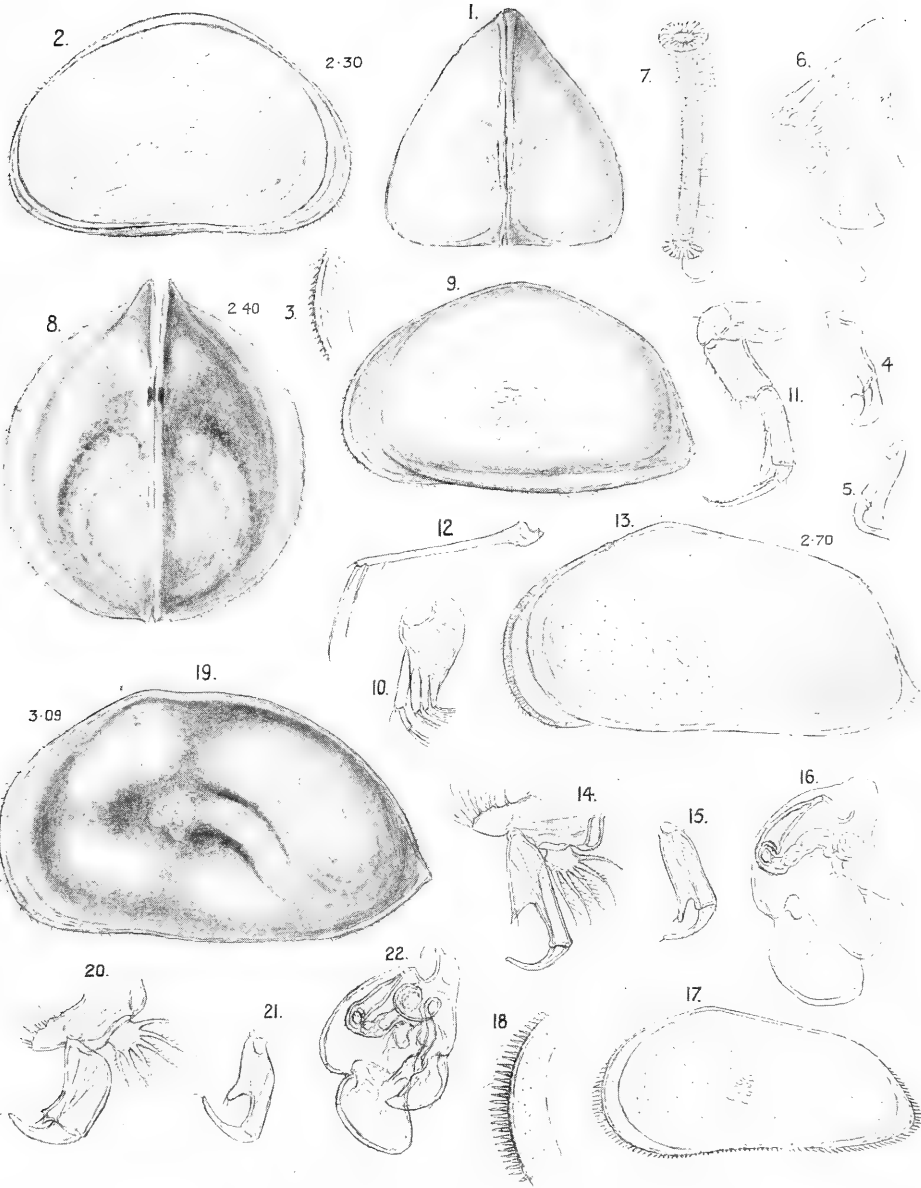
Afrocypris barnardi g. et sp. n.

1. Adult female, seen from left side.
2. Same, dorsal view.
3. Piece of anterior part of right valve from inner face, to show the double striated rims.
4. Anterior antenna.
5. Posterior antenna.
6. Mandible with palp.
7. Maxilla with vibratory plate.
8. Maxilliped.
9. Anterior leg.
10. Posterior leg.
11. Extremity of same leg, more highly magnified.
12. Posterior part of body seen from left side, with caudal ramus and genital lobe.
13. Left valve of adult male with enclosed body (right valve removed), to show the several appendages *in situ* and the translucent ejaculatory tubes, as also the arrangement of the spermatozooids within the body.
14. Right maxilliped of male.
15. Palp of left maxilliped.
16. Palp of right maxilliped from an immature male.
17. Copulatory appendage of adult male.
18. Ejaculatory tube.

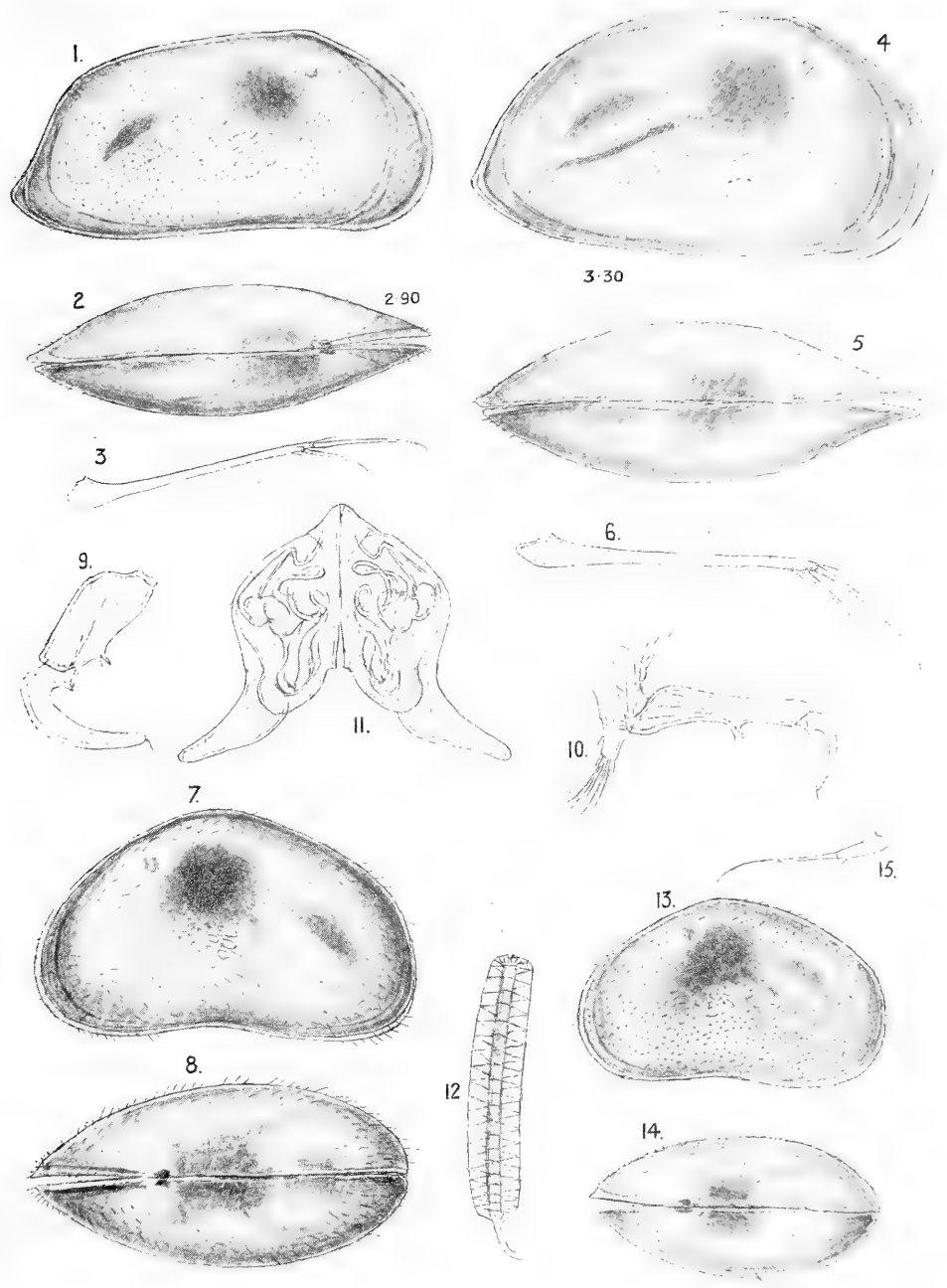


del. G. O. Sars.

SOUTH-WEST AFRICAN OSTRACODA.

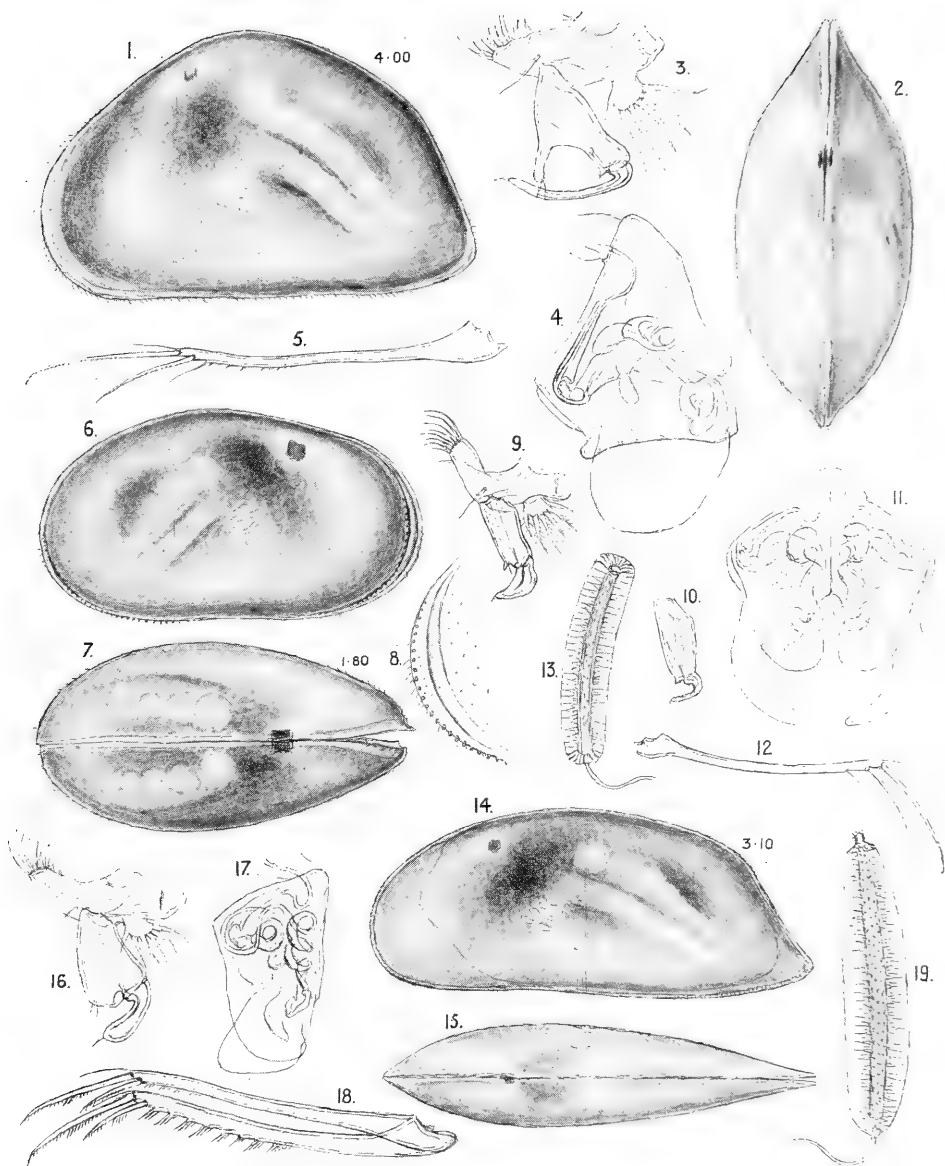


del. G. O. Sars.



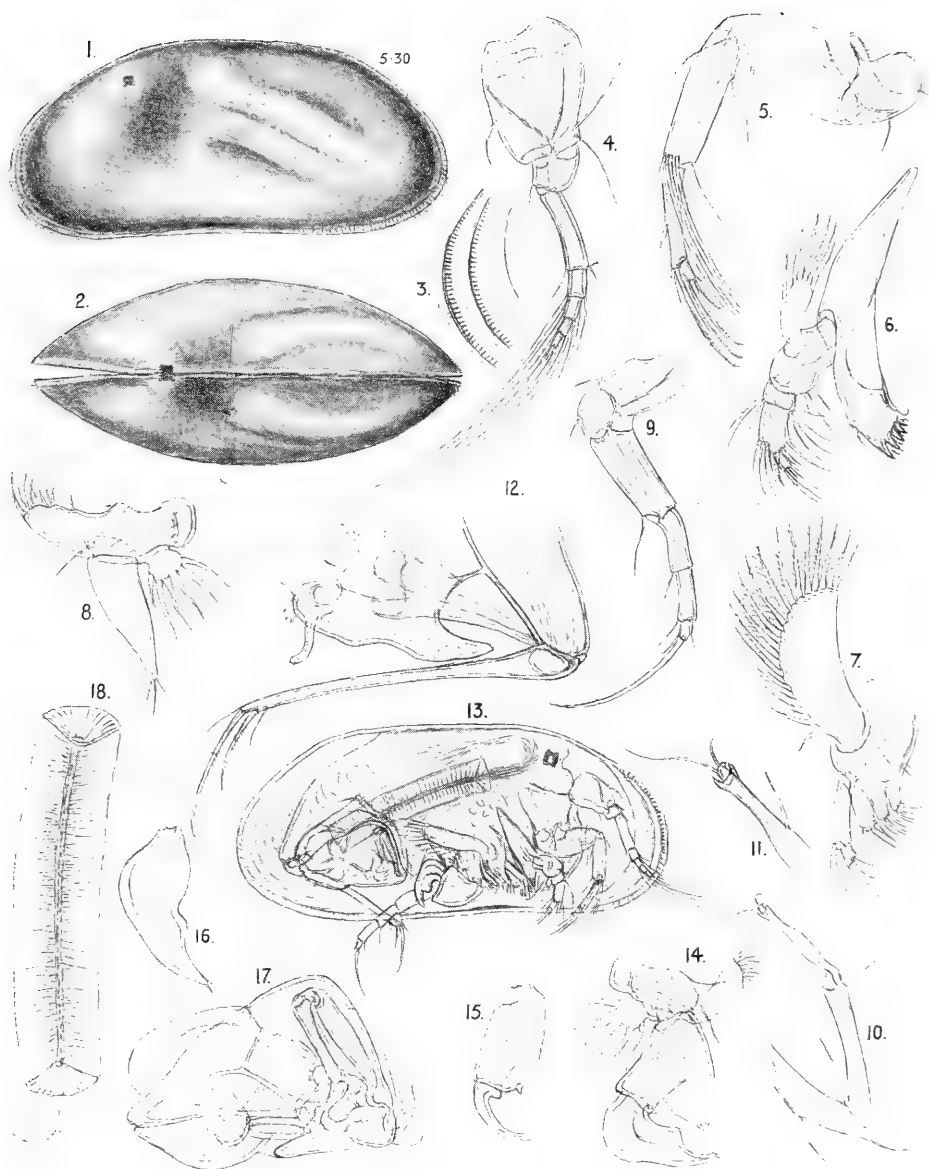
del. G. O. Sars.

SOUTH-WEST AFRICAN OSTRACODA.



del. G. O. Sars.

SOUTH-WEST AFRICAN OSTRACODA.



del. G. O. Sars.

SOUTH-WEST AFRICAN OSTRACODA.

4. *Contributions to a Knowledge of the Fauna of South-West Africa.*

II: Crustacea Entomostraca, Phyllopoda. By K. H. BARNARD,
M.A., F.L.S., F.R.S.S.Afr., Assistant Director.

(With Plate XXVI.)

THE following report contains records of 26 species, 12 of which are described as new. For the region under discussion there were previously only 2 species recorded. This large increase in the faunalist was only to be expected as but little collecting for these animals had been done in the country. Yet further additions can be confidently expected. An analysis of the records shows that the middle section of the country, Damaraland, has fewer species than either of the other two sections, which cannot be regarded as expressing the real truth. It means probably that less collecting has been done there than elsewhere. From the Kaokoveld and Namib not one species has yet been recorded.

Thus Great Namaqualand has 11 species, Damaraland 6, and Ovamboland 17. Ovamboland has been systematically searched during two seasons.

In the proportion of new species Ovamboland easily comes first. Of the 17 species 10 are new. From Damaraland there is only 1 new species and from Namaqualand 2 (1 of which is also found in Ovamboland).

The fauna of Great Namaqualand strongly resembles that of Bushmanland, South of the Orange River, and the Western part of the Cape Province. It is characterised by such forms as *Apus namaquensis* and *Leptestheria rubidgei*.

Ovamboland, on the other hand, with its 10 new species has a very distinctive and more subtropical facies. The presence of, e.g., *Streptocephalus macrourus* and *Caenestheriella joubini* indicates resemblance to the fauna of the Orange Free State and Transvaal.

Several of the species are not only common to South Africa but widely distributed over the whole of Africa, e.g. *Apus numidicus*, *Eulimnadia africana* and *Cyclestheria hislopi*.

Only 2 species are common to all three sections of South-West Africa: *Apus numidicus* and *Branchipodopsis wolffi*.

Only the main references are given here, as I propose giving a full bibliography in my "Revision of the Phyllopoda of South Africa."

NOTOPHYLLA Stebb. (=NOTOSTRACA Sars).

Family APODIDAE.

Gen. APUS Schaeffer.

1756. Schaeffer, Monogr. d. krebsart. Kiefenfusse, p. 131.

Two species, each with a varietal form, are found in South-West Africa. Both are widely distributed over the drier and desert areas of the whole of Africa.

Apus numidicus Grube.

1865. Grube, Arch. Naturg., vol. xxxi, p. 278, pl. xi, fig. 14 *a, b*.

1899. Sars, Arch. Naturv. Kristian., vol. xxi, No. 4, p. 15, pl. ii, figs. 1, 2 (*trachyaspis*).

Carapace a little but distinctly longer (including posterior angles) than broad, usually (but not always) convex along whole lateral margin to posterior angle, smooth or sometimes in the largest specimens with minute granules; denticles along posterior sinus, 34-50; number of apodous segments, 11-14 in ♂, 9-12 in ♀.

A. trachyaspis can only be regarded as an occasional rough form of the typical *numidicus*. I intend to give the evidence, derived from the examination of a large amount of material from many localities, in a later paper.

Length (from front of carapace to end of median keel).—Up to 24 mm. (♂ and ♀).

Colour.—Amber coloured, often more or less olivaceous.

Locality.—Great Namaqualand: Gibeon (R. W. E. Tucker, 1916); Kalkfontein South (J. S. Brown, 1923). Damaraland: Gobabis (Miss Wilman, 1921); Ovamboland: Ondongua (K. H. Barnard, 1921); Ongka, N. of Ondongua; Onolongo and Uwuthija, S.W. of Ondongua (K. H. Barnard, 1923).

Apus namaquensis Richt.

1886. Richters, Ber. Senck. Ges., 1886.

1899. Sars, Arch. Naturv. Kristian., vol. xxi, No. 4, p. 6, pl. i, figs. 1-8 (*namaquensis*), and p. 12, pl. i, figs. 9-13 (*sculleyi*).

1907. Thiele, S.B. Ges. naturf. Fr. Berlin., 190 T., No. 9, p. 290 (*elongatus*).

Carapace as broad as long, or only very slightly longer than broad, usually slightly concave near posterior angles, smooth or rough; denticles along posterior sinus, 46-54; number of apodous segments, 15-18 in ♂, 12-13 in ♀.

A. sculleyi is an occasional rough variety, corresponding with *trachyaspis*.

Length (measured as above).—♂ 15 mm., ♀ 13 mm.

Colour.—Amber coloured, more or less olivaceous.

Locality.—Great Namaqualand: Angra Pequena (Richters); Kalkfontein South (J. S. Brown, 1923).

Apus ovamboensis n. sp.

Carapace longer than broad, not concave near posterior angles, smooth; posterior sinus narrow, longer than deep, with 32-36 denticles along its margin; number of apodous segments, 6-7 in ♂, 5-6 in ♀.

Length (measured as above).—Up to 17 mm.

Colour.—Horny coloured, more or less olivaceous.

Locality.—Ovamboland: Onambeke, Onolongo, and Uwuthija, S.W. of Ondongua; Ukualuthi, N.W. of Ondongua (K. H. Barnard, 1923).

This species is at once distinguished from the other species by the shortness of the "tail"; the length of the exposed segments not exceeding $\frac{2}{3}$ the median length of the carapace, whereas in the other two species it is at least as long, usually considerably longer. It is perhaps nearest to *abyssinicus* Richt. (of which *bottegoi* Prato is very probably a synonym), but has even fewer apodous segments than that species. In the ♀ the number of apodous segments is more frequently 5 than 6, and the characters are constant in ovigerous specimens from 7 mm. up to 17 mm.

GYMNOPHYLLA Stebb. (=ANOSTRACA Sars).

Family CHIROCEPHALIDAE Daday.

Lower antennae of ♂ 2-jointed, their bases not fused.

Gen. BRANCHINELLITES Daday.

1910. Daday, Ann. Sci. Nat. Zool., vol. xii, p. 254.

Frontal process of ♂ long, bifurcate. Lower antennae of ♂ with a spinigerous process at lower anterior angle of 1st joint, 2nd

joint simple, rather strongly chitinised. Marsupium flask-shaped, moderately long.

Branchinellites ondonguae n. sp.

(Plate XXVI, fig. 1.)

Moderately stout, abdomen (without cerci) shorter than rest of body, smooth. Cerci equal to last 4 abdominal segments together, both margins with plumose setae. Upper antenna slender, longer in ♀ than ♂. Frontal process in ♂ elongate, when stretched out equal to length of head and body, apically twice bifid; basal part with a proximal and distal group of large spines on each infero-lateral margin, 2nd part as far as 1st bifurcation rather shorter than basal part, armed on ventro-lateral margins with spines of various sizes, apical part biramous, each ramus again biramous, these ramuli subequal in length, the inferior one entire (not cheliform as in other species), armed with spines of varying size. Lower antenna in ♂ 2-jointed, 1st joint with large spines on its anterior margin, distal anterior angle produced in an elongate, coiled process armed with spines on its inner surface, 2nd joint curved, apically somewhat clavate. Lower antenna in ♀ slender, 6-7 times as long as broad, apically acute. Copulatory appendages of ♂ very long, reaching to end of 7th abdominal segment, somewhat club-shaped, margin serrate. Marsupium reaching to end of 5th abdominal segment, flask-shaped, basally swollen, apically acute.

Length (from front of head to base of cerci).—♂ and ♀ up to 27 mm.

Colour.—♂ whitish, ♀ greenish brown.

Locality.—Ovamboland: Ondongua (K. H. Barnard, 1921); Ongka, N. of Ondongua (K. H. Barnard, 1923).

Family BRANCHIPODIDAE Daday.

Lower antennae of ♂ 2-jointed, their bases fused into a strongly chitinised clypeus. Marsupium short, ovoid.

Gen. BRANCHIPODOPSIS G. O. Sars.

1898. G. O. Sars, Arch. Naturv. Kristian., vol. xx, No. 4, p. 26.

A small clavate median process in ♂ between the fused bases of lower antennae. Basal joint of lower antennae in ♂ with a conical, subconical, or digitiform process on inner anterior side; 2nd joint unciform, simple, curved inwards.

Branchipodopsis wolfi Daday.

1910. Daday, Ann. Sci. Nat. Zool., vol. xi, p. 304, fig. 52 *a-i*.

Process of basal joint of lower antennae of ♂ with 2 apical tubercles.

Last abdominal segment of ♂ with 2 short spines below.

Length.—♂ up to 11 mm., ♀ 10 mm.

Colour.—Translucent, marsupium cobalt blue.

Locality.—Great Namaqualand: near Gibeon (R. W. E. Tucker, 1916); Damaraland: Waterberg (R. W. E. Tucker, 1920); Ovamboland: Ongandjera (K. H. Barnard, 1923).

Branchipodopsis tridens Daday.

1910. Daday, Ann. Sci. Nat. Zool., vol. xi, p. 308, fig. 53 *a-h*.

Process of basal joint of lower antennae of ♂ with a strong conical tooth arising near base. Last abdominal segment of ♂ with 2 short spines below.

Length.—Up to 13 mm.

Colour.—Translucent.

Locality.—Great Namaqualand: near Gibeon (R. W. E. Tucker, 1916).

Branchipodopsis simplex n. sp.

(Plate XXVI, figs. 2, 3.)

Process of basal joint of lower antenna of ♂ conical, the dorsal edge keeled, with a subterminal notch. Median process between bases of antennae obsolete. Last abdominal segment of ♂ without spines below.

Length.—8 mm.

Colour.—Translucent, marsupium cobalt blue.

Locality.—Ovamboland: Eunda (K. H. Barnard, 1923).

Branchipodopsis browni n. sp.

(Plate XXVI, fig. 4.)

Process of basal joint of lower antenna of ♂ subconical, with a small acute point on inner margin near apex; oval flap near apex of basal joint larger than in any of the other species. Last abdominal segment of ♂ with 2 short spines below.

Length.—10 mm.

Colour.—Translucent.

Locality.—Great Namaqualand: Kalkfontein South (J. S. Brown, 1923).

Although closely allied to *hodgsoni* and the other species of the genus, this form seems worthy of specific rank. The spines on last abdominal segment in ♂ differentiate it at once from *hodgsoni*.

Family STREPTOCEPHALIDAE Daday.

Lower antennae of ♂ 3-jointed. Marsupium long and cylindrical.

Only one genus, subdivided into 3 subgenera.

Gen. STREPTOCEPHALUS Baird.

1852. Baird, Proc. Zool. Soc., p. 20.

Key to the species of Streptocephalus found in South-West Africa.

- | | |
|--|----------------------------|
| Frontal process in ♂ very short (<i>Streptocephalellus</i>) . . . | <i>papillatus</i> Sars. |
| Frontal process in ♂ moderate (<i>Streptocephalus</i>). | |
| Frontal process with apex entire, pointed or obtuse. | |
| Cerci slender | <i>macrourus</i> Daday. |
| Cerci stout | <i>ovamboensis</i> n. sp. |
| Frontal process with apex bifid or emarginate. | |
| A serrate process between bases of frontal process and lower antenna | <i>cafer</i> Loven. |
| No such process | <i>indistinctus</i> n. sp. |
| Frontal process in ♂ very long (<i>Streptocephalopsis</i>). | |
| Frontal process without lateral branches | <i>proboscideus</i> Frfld. |
| Frontal process with lateral branches | <i>cladophorus</i> n. sp. |

The females of all species are so similar that rarely can an isolated female specimen be identified with certainty.

Streptocephalus papillatus Sars.

1905. G. O. Sars, Arch. Naturv. Kristian., vol. xxvii, No. 4, p. 4, pl. i.

1910. Daday, Ann. Sci. Nat. Zool., vol. xi, p. 343, fig. 61.

Abdominal segments in ♂ with numerous small spines along lateral margins; segment 6 with 2 large dorsal unciform recurved spines, segment 7 with 1 medio-dorsal rounded or subacute process; in ♀ all segments smooth. Cerci not long, in ♂ falciform, the tips curved inwards, outer margin and basal half of inner margin with plumose setae, apex with simple spine-setae, distal half of inner margin with 6-9 digitiform or spiniform processes which are apically setulose;

in ♀ straight or slightly falciform, both margins with plumose setae. Frontal process in ♂ very short, deflexed, apex often slightly bifid. Lower antenna in ♂ very long, appendage of 1st joint rather stout, apically blunt, 2nd joint with numerous spiniform processes on posterior margin, 3rd joint bifurcate, anterior prong elongate, tapering to an acute apex, with a stout bifid spiniform process near base on anterior margin, and numerous small digitiform papillae scattered along its whole length, posterior prong elongate, tapering, but not so acutely pointed as anterior prong, with numerous digitiform papillae scattered along its whole length, and an uncinat process on inner posterior margin near base. Lower antenna in ♀ broadly ovate with a minute apical point.

Length.—♂ 21 mm., ♀ 17 mm.

Colour.—Translucent.

Locality.—Great Namaqualand: Kalkfontein South (J. S. Brown, 1923).

Streptocephalus macrourus Daday.

1910. Daday, Ann. Sci. Nat. Zool., vol. xi, p. 383, fig. 76.

Abdominal segments smooth. Cerci in ♂ elongate, slender, filiform, outer margin with short plumose setae, basal half of inner margin of rather longer plumose setae, near base thickly aggregated like a brush, distal half of inner margin with rather widely spaced spine-setae of unequal lengths; in ♀ shorter and stouter than in ♂, both margins with long plumose setae. Frontal process in ♂ rather long, deflexed, apex subacutely pointed. Lower antenna in ♂ short, filamentous appendage of basal joint tapering to a pointed apex, 2nd joint without any flap-like or spiniform processes, 3rd joint bifurcate anterior prong spoon-shaped at base, with acute tooth on anterior margin, bifurcate, anterior process elongate, angularly bent, tapering to a fine point, posterior process shorter, straight, 2 blunt teeth between the two processes, posterior prong curved, with basal lobe-like tooth and subacute apex. Lower antenna in ♀ oblong.

Length.—♂ 15–22 mm., ♀ 18–20 mm.

Colour.—♂ translucent or often pale sea-green, ♀ usually violet; cerci especially in ♀ bright orange or red.

Locality.—Ovamboland: widely distributed numerous localities (K. H. Barnard, 1923).

Originally recorded from Bloemfontein. The S.A. Museum has specimens also from Kimberley and the Transvaal. This species is closely related to the Soudanese *vitreus* (Brauer).

Streptocephalus ovamboensis n. sp.

Abdominal segments smooth. Cerci stout, straight, both margins with long plumose setae. Frontal process in ♂ strong, deflexed, reaching half way along basal joint of lower antenna, apically obtuse and entire. Lower antenna in ♂ long, basal joint with slender, tapering appendage, 2nd joint with digitiform processes on anterior margin near first bend and on inner margin between first and second bends, 3rd joint bifurcate, anterior prong elongate, bifurcate, anterior process elongate, slender, angularly bent, tapering to a fine point, the anterior margin serrate distally, and with a short pointed tooth basally, posterior process shorter, apically clavate, between the two processes a slender tooth-like process, posterior prong strongly arcuate (but not angularly bent) with a deep sinus beyond the basal spoon-like portion. Lower antenna in ♀ oblong-ovate.

Length.—♂ 18 mm., ♀ 16 mm.

Colour.—♂ translucent, ♀ light brownish, cerci especially in ♀ bright orange.

Locality.—Ovamboland : Ukualonkathi (K. H. Barnard, 1923).

This species is close to *torvicornis* (Waga) and its varieties (especially var. *bucheti* Daday), but distinct in the narrow tooth between the anterior and posterior processes of the anterior prong of 3rd joint of antenna. This character appears to be quite constant, and I have seen exactly similar specimens from Gordonias and Hanover in the Cape Province. The digitiform processes on 2nd joint, however, vary in number considerably.

Streptocephalus cafer (Loven).

1847. Loven, K. Vet. Ak. Handl. for 1845, p. 433, pl. v, figs. 1–20.

1910. Daday, Ann. Sci. Nat. Zool., vol. xi, p. 392, fig. 79 a–g.

Abdominal segments smooth. Cerci not very long, in ♂ more or less falciform, outer margin and basal half of inner margin with long plumose setae, distal half of inner margin with spine setae which project vertically upwards; in ♀ straight, both margins with long plumose setae. Frontal process in ♂ rather long, deflexed, apex more or less deeply bifid, sometimes with a small tooth in the notch. Lower antenna in ♂ stout, 1st joint with elongate, tapering filamentous appendage near apex, and a lanceolate flap-like process with serrate edge at extreme base on inner side; 2nd joint short, inner surface and lower margin at lower bend with a varying number of lamellate or spiniform processes; 3rd joint bifurcate, basally swollen, anterior prong bifurcate, with spoon-like expansion at base, anterior process

long, angularly bent, apically acute, posterior process short and acute, a small tooth between the two processes, posterior prong with spoon-like basal expansion, whose apex forms a tooth followed by a notch, distal part of prong compressed, angularly bent, apically acute. Lower antennae in ♀ oblong, ovate, with a small apical point.

Length.—♂ up to 17 mm., ♀ up to 14 mm.

Colour.—Translucent.

Locality.—Great Namaqualand: Gibeon (R. W. E. Tucker, 1916); Damaraland: Otjiwarongo (R. W. E. Tucker, 1920).

Streptocephalus indistinctus n. sp.

Abdominal segments smooth. Cerci straight, both margins with rather stout, plumose setae. Frontal process in ♂ moderately long, deflexed, apex slightly emarginate. Lower antenna in ♂ short, basal joint with moderately long, apically subacute appendage, 2nd joint short with a variable series of lamellate processes along inner surface, 3rd joint bifurcate, basal posterior angle more or less conically projecting, anterior prong bifurcate, somewhat spoon-shaped basally, anterior process elongate, slender, angularly bent, apically acute, posterior process short, acute, a small blunt tooth between the two processes, posterior prong slender, angularly bent, apically acute. With a blunt lobe-like tooth on anterior margin. Lower antenna in ♀ oblong, with a minute apical point.

Length.—♂ 18 mm., ♀ 14 mm.

Colour.—Translucent, more or less violet, cerci orange.

Locality.—Great Namaqualand: Kalkfontein South (J. S. Brown, 1923); Ovamboland: Onolongo, and Onambeke, S.W. of Ondongua (K. H. Barnard, 1923); Ongka, N. of Ondongua (K. H. Barnard, 1923); Umtekwa, near Tamansu (K. H. Barnard, 1923).

This species differs from *distinctus* Th. from Madagascar, in the cerci not having finely tapering filiform apices set with spinules. The specimens are fully developed (I have ♂♂ and ovigerous ♀♀ also from the Transvaal), and the form seems worthy of specific rank although so closely allied to *distinctus*.

Streptocephalus proboscideus (Frfd.).

1873. Frauenfeld, Vert. k.k. Zool. bot. Gesell. Wien., vol. xxiii, p. 189.

1910. Daday, Ann. Sci. Nat. Zool., vol. xi, p. 395, fig. 80.

Abdominal segments smooth. Cerci not very long, both margins

in both sexes with long plumose setae. Frontal process in ♂ long, reaching lower bend of 2nd joint of lower antenna, apex bifid, lower margin with numerous flexible spine-like processes diminishing in size distally, and varying in number and size. Lower antenna of ♂ about half length of body, moderately stout, appendage filamentous, tapering to a point; 2nd joint elongate, usually with spiniform appendages at the upper bend, and with spiniform or lamellate processes on inner surface at lower bend (these processes very variable); 3rd joint bifurcate, the prongs about equal in length, anterior prong bifurcate, the anterior process long, sharply pointed, the posterior one short and acute, a small blunt tooth between them, the posterior prong curved, inner margin sharp with 2 strong teeth at base, distal part bent at right angles, tapering to an acute point. Lower antennae in ♀ ovate, apically rounded, with or without a minute apical point.

Length.—♂ up to 19 mm., ♀ up to 15 mm.

Colour.—Translucent, cerci orange.

Locality.—Damaraland: Gobabis (Miss Wilman, 1921); Ovambo-land: Onambeke, S.W. of Ondongua (K. H. Barnard, 1923).

Originally recorded from the Soudan (Khartoum). In the South African Museum there are specimens from several other South African localities outside the region here discussed.

Streptocephalus cladophorus n. sp.

Abdominal segments smooth. Cerci in both sexes short, rather stout, both margins with long plumose setae. Frontal process in ♂ very elongate, almost as long as lower antenna, with 2 apical branches and a lateral one, posterior (lower) margin of main trunk and branches with spiniform processes of varying length. Lower antenna in ♂ rather long, filamentous process of basal joint rather stout, apically subacute, 2nd joint without flap-like processes, 3rd joint bifurcate, anterior prong spoon-shaped at base, bifurcate, anterior process long, curved, slender and tapering to a fine point, posterior process shorter, apically acute, bases of both processes rather broad, contiguous, without intervening tooth, posterior prong elongate, slender, arcuately curved, with small obscure tooth near base. Lower antenna in ♀ oblong, with small point on inner apical angle.

Length.—Up to 14 mm. (♂ and ♀).

Colour.—Various shades of pale blue, blue-green, and violet; ♀ deeper in colour than ♂, cerci bright orange.

Locality.—Ovamboland: widely distributed, numerous localities (K. H. Barnard, 1921 and 1923).

This species resembles most nearly *neumanni* Th. from Central Africa in the shape of the frontal process in ♂; in *neumanni*, however, the apex is entire and the lateral branch biramous.

This species and *macrourus* are the two commonest species in Ovamboland. They are both beautifully coloured in life, but the present species exhibits a wonderful range of tints from a pale blue to a bright violet.

CONCHOPHYLLA Stebb. (=CONCHOSTRACA Sars).

Family LIMNADIDAE.

Head with frontal appendage. 17–32 pairs of legs, 1st and 2nd pairs in ♂ prehensile.

Gen. EULIMNADIA Pack.

1874. Packard, Rep. Peabody Ac. Sci., vol. vi, p. 55.

Eulimnadia africana (Brauer).

1877. Brauer, S.B. Ak. Wiss. Wien., vol. lxxv, p. 608, pls. vii, viii.

Shell oval, thin, pellucid, growth-lines few and indistinct.

Size.—♂ 8.5 × 5 mm., ♀ 9.5 × 7 mm.

Colour.—Pale horny colour, more or less tinged with green.

Locality.—Great Namaqualand: near Gibeon (R. W. E. Tucker, 1916); Ovamboland: widely distributed (K. H. Barnard, 1921 and 1923).

Family CYCLESTHERIIDAE.

Head without frontal appendage. Rostrum apically serrate, 16 pairs of legs, 1st pair in ♂ prehensile. 1st antenna simple, unjointed.

Gen. CYCLESTHERIA Sars.

1887. G. O. Sars, Forh. Selsk. Kristian.

Cyclestheria hislopi (Baird).

1859. Baird, Proc. Zool. Soc., Lond., p. 232, pl. lxiii, figs. 1, 1b.

Size.—4–5 mm. diameter.

Colour.—Pale horn colour, more or less tinged with green.

Locality.—Ovamboland: Uwuthija, Tamansu, Ukualuthi, Ukua-lonkathi (K. H. Barnard, 1923).

Family LYNCEIDAE.

Head without frontal appendage. Rostrum spatulate. 10–12 pairs of legs, 1st (rarely also 2nd) pair in ♂ prehensile.

Gen. LYNCEUS O. F. Müll.

1776. O. F. Müller, Zool. Dan. Prodr., pp. xxvii, 199.

Only the 1st pair of legs in ♂ prehensile.

Lynceus truncatus n. sp.

(Plate XXVI, figs. 5–11.)

Shell subcircular, slightly deeper anteriorly, moderately tumid. Eyes large, kidney-shaped, contiguous in front. Head behind eyes straight or slightly concave in side view. Rostrum prominent, with single median keel. In ♂ truncate, diamond-shaped in ventral view, the lateral keel of the fornix forming small but prominent spiniform projections. In ♀ also obliquely truncate but produced below somewhat like a shovel, the lower margin convex and minutely denticulate. Prehensile hand of ♂, oblong, longer than broad, whole inner margin with stout spines and numerous spine-setae, the latter often bifid, the longer of the 2 distal appendages somewhat club-shaped at apex. Posterior lamellae of ♀ with 4 curved processes (as represented by Thiele for *L. rotundus*, 1907).

Size.—Diameter 3 mm., thickness 1.8 mm.

Colour.—Horny.

Locality.—Ovamboland : Ukualuthi (K. H. Barnard, 1923).

Lynceus bicarinatus n. sp.

(Plate XXVI, figs. 12–15.)

Shell subcircular, slightly deeper anteriorly, moderately tumid. Eyes not very large, kidney-shaped, contiguous in front. Head behind eyes nearly straight in side view. Rostrum with double median keel. Nearly similar in outline in both sexes, rather more convex in ♂ than ♀, obliquely truncate, lateral keel of fornix not projecting. Ventral margin finely denticulate. Prehensile hand of ♂ subtriangular, widening distally, forming a distinct palm set with stout spines and finer spine-setae, finger equal to palm, the longer of the two distal appendages tapering distally. Posterior lamellae in ♀ with 4 curved processes (as in *truncatus* and *rotundus*).

Size.—Up to diameter 8 mm., thickness, 4.5 mm. The size is variable; there are ovigerous ♀♀ 4 mm. in diameter up to 6 mm. The largest specimen 8 mm. is a ♂.

Colour.—Horny, with slight greenish tinge.

Locality.—Ovamboland: Ongka, Onambeke, Tamansu, and Ukualuthi (K. H. Barnard, 1923).

This species is close to the East African *L. jeanneli* Daday, 1913, but there are differences in the shape of the head, the prehensile hand of ♂, and the rostrum has a *double* keel in both sexes in *bicarinatus*. In this latter character it resembles *L. wahlbergi* Loven. Only the ♀ of Loven's species is known, but it has the rostrum far more dilated than in the present species.

Family CAENESTHERIIDAE.

Head without frontal appendage. Rostrum unarmed. 20–27 pairs of legs, 1st and 2nd pairs in ♂ prehensile, 9th and 10th pairs in ♀ ovigerous.

Gen. CAENESTHERIELLA Daday.

1913. Daday, Math. es Termt. Ert. Budapest, 31.

Rostrum acute in both sexes. Occipital process of head more or less acutely produced.

Caenestheriella elizabethae (Sars).

1898. G. O. Sars, Arch. Naturv. Kristian., vol. xx, No. 4, p. 33, pl. 1.

1915. Daday, Ann. Sci. Nat. Paris, 9 ser., vol. xx, p. 175, fig. 37.

Shell without an angle between dorsal and posterior margins. Punctuation aggregated into transverse lines with pellucid intervals.

Size.—8×5 mm.

Colour.—Yellowish.

Locality.—Damaraland: Windhoek (Daday).

Caenestheriella joubini Daday.

1915. Daday, Ann. Sci. Nat. Paris, 9 ser., vol. xx, p. 148, fig. 29.

Shell with dorsal and posterior margins forming an angle. Punctuation aggregated into transverse lines with pellucid intervals.

Size.—7.5×5 mm.

Colour.—Yellowish or brownish, ova reddish.

Locality.—Ovamboland: Ondongua (K. H. Barnard, 1921); Onolongo and Tamansu (K. H. Barnard, 1923).

Caenestheriella vidua Daday.

1915. Daday, Ann. Sci. Nat. Paris, 9 ser., vol. xx, p. 122, fig. 21.

Shell with dorsal and posterior margins forming an angle. Puncturation dense and irregular, not aggregated into lines.

Size.— 6×4 mm.

Colour.—Yellowish horn colour (as preserved).

Locality.—Great Namaqualand: near Gibeon (R. W. E. Tucker, 1916); Kalkfontein South (J. S. Brown, 1923).

Gen. *Eocyzius* Daday.

1915. Daday, Ann. Sci. Nat. Paris, ser. 9, vol. xx, p. 190.

Rostrum in ♂ broadly expanded, in ♀ acute or subacute. Occipital process of head rounded quadrangular, not produced.

Eocyzius gigas n. sp.

(Plate XXVI, figs. 16, 17.)

Shell ovoid, dorsal margin passing imperceptibly into posterior margin. Punctae aggregated into larger closely-set punctae. Frontal margin of head concave, more so in ♂ than ♀. Rostrum in ♂ broadly expanded, oblong, the rostral angle obtuse, *i.e.* a line drawn along the lower margin of rostrum forms an obtuse angle with a line drawn along the frontal margin; lower and hind margins subequal. Rostrum in ♀ subacute, the hind margin evenly convex. 20–21 pedigerous segments. Interior margin of hand of 1st and 2nd legs in ♂ with a deep notch.

Size.— 13×8.5 mm.

Colour.—Horn colour with a greenish or olivaceous tinge.

Locality.—Ovamboland: Ukualuthi and Ukualonkathi (K. H. Barnard, 1923).

This species is considerably larger than any of the other species of the genus. In the number of pedigerous segments and shape of shell it is closely allied to *E. obliquus* Sars from the Cape Province. The obtuse-angled rostrum of the ♂ and the concave frontal margin in both sexes, form a ready means of distinguishing the two species.

Family LEPTESTHERIIDAE.

Head without frontal appendage. Rostrum armed with an apical spine. 20–27 pairs of legs, 1st and 2nd in ♂ prehensile, 9–10th to 15th pairs in ♀ ovigerous.

Gen. LEPTESTHERIA Sars.

Rostrum in ♂ rounded, in ♀ subacute. Occipital process of head produced.

Leptestheria rubidgei (Baird).

1862. Baird, Proc. Zool. Soc., p. 148, pl. xv, figs. 3–3b.

1862. Baird, *ibid.*, p. 148, pl. xv, figs. 5–5b (*macgillivrayi*).

1898. G. O. Sars, Arch. Naturv. Kristian., vol. xx, No. 6, p. 11, pls. ii, iii (*siliqua*).

1899. G. O. Sars, *ibid.*, vol. xxi, No. 4, p. 23, pl. iii.

Sculpturing reticulate. 23 pedigerous segments.

Size.—♂ 11×5.5 mm., ♀ 9×5 mm.

Locality.—Great Namaqualand: near Gibeon (R. W. E. Tucker, 1916).

Leptestheria brevirostris n. sp.

(Plate XXVI, fig. 18.)

Shell resembling that of *L. rubidgei*, reticulate. Animal with 23 pedigerous segments. Occipital process strongly produced backwards, acute. Rostrum very short, apically acute (♀).

Size.—4.5×2.5 mm.

Colour.—Pale horny.

Locality.—Damaraland: Waterberg (R. W. E. Tucker, 1920).

Only two specimens of this form were collected, an ovigerous ♀ and a younger specimen. Both have the short rostrum and elongated occipital process which distinguishes them from *rubidgei* and which seem to justify the institution of a new species.

Leptestheria striatoconcha n. sp.

(Plate XXVI, fig. 19.)

Shell thin, pellucid, oblong-oval, hinge-line straight, forming distinct angles with both anterior and posterior margins. Umbo fairly prominent. Growth-lines distinct, about 12, each with a row of fine

reflexed setules anteriorly; these setules are much more numerous in the young. Sculpturing lineato-striate consisting of series of sub-continuous striae which are longitudinal anteriorly and in the middle of the shell, but become oblique and finally transverse to the lines of growth posteriorly. Animal closely resembling that of *L. rubidgei*. Shape of rostrum and occipital process similar; 22-23 pedigerous segments. Prehensile hand of ♂ similar to that of *rubidgei*.

Size.—Up to 9×6 mm.

Colour.—Horn coloured, ova salmon-pink.

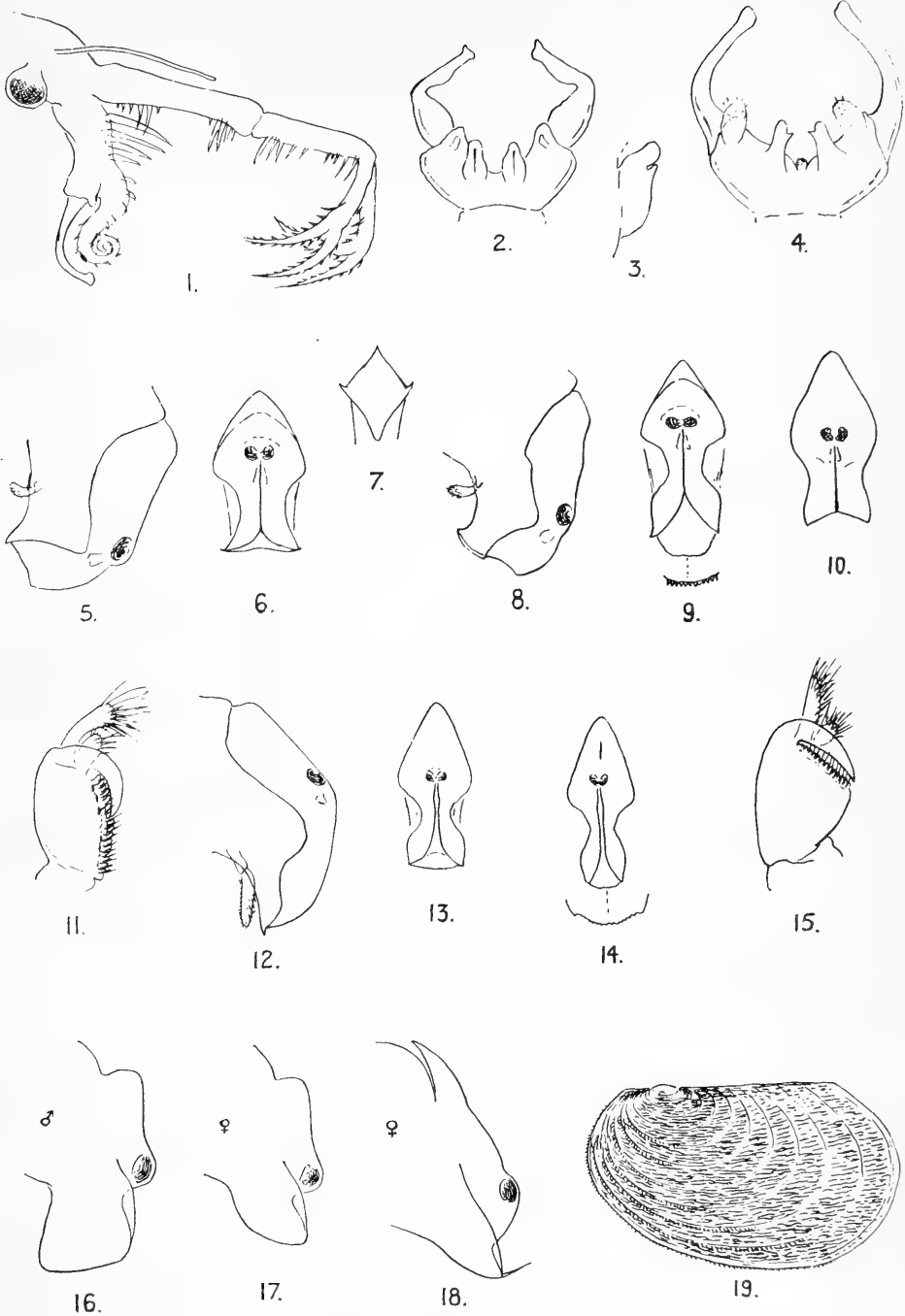
Locality.—Ovamboland: widely distributed from Andoni northwards to Eunda (K. H. Barnard, 1923).

This species is at once distinguished from *rubidgei* by the striated shell. It appears to be characteristic of Ovamboland; I have not seen any specimens amongst the abundant material in the South African Museum from many parts of the Cape Province, Bushmanland, and Great Namaqualand.

EXPLANATION OF PLATE.

FIG.

- | | | |
|--|---|--|
| 1. <i>Branchinellites ondonguae</i> n. sp. | ♂ | Head with frontal process and one of the 2nd antennae. |
| 2. <i>Branchipodopsis simplex</i> n. sp. | ♂ | Lower antennae in dorsal view. |
| 3. <i>Branchipodopsis simplex</i> n. sp. | | Lateral view of basal process. |
| 4. <i>Branchipodopsis browni</i> n. sp. | ♂ | Lower antennae in dorsal view. |
| 5. <i>Lynceus truncatus</i> n. sp. | ♂ | Side view of head. |
| 6. <i>Lynceus truncatus</i> n. sp. | ♂ | Frontal view of head. |
| 7. <i>Lynceus truncatus</i> n. sp. | ♂ | Ventral view of rostrum. |
| 8. <i>Lynceus truncatus</i> n. sp. | ♀ | Side view of head. |
| 9. <i>Lynceus truncatus</i> n. sp. | ♀ | Frontal view of head. |
| 10. <i>Lynceus truncatus</i> n. sp. | ♀ | Dorso-frontal view of head. |
| 11. <i>Lynceus truncatus</i> n. sp. | ♂ | Hand of 1st leg. |
| 12. <i>Lynceus bicarinatus</i> n. sp. | ♂ | Side view of head. |
| 13. <i>Lynceus bicarinatus</i> n. sp. | ♂ | Frontal view of head. |
| 14. <i>Lynceus bicarinatus</i> n. sp. | ♀ | Frontal view of head. |
| 15. <i>Lynceus bicarinatus</i> n. sp. | ♂ | Hand of 1st leg. |
| 16. <i>Eocyclus gigas</i> n. sp. | ♂ | Side view of head. |
| 17. <i>Eocyclus gigas</i> n. sp. | ♀ | Side view of head. |
| 18. <i>Leptestheria brevirostris</i> n. sp. | ♀ | Side view of head. |
| 19. <i>Leptestheria striatoconcha</i> n. sp. | | Lateral view of shell. |



del. K.H.B.

SOUTH-WEST AFRICAN PHYLLOPODA.

5. *Contributions to a Knowledge of the Fauna of South-West Africa.*

III: Crustacea Isopoda Terrestria. By K. H. Barnard, M.A., F.L.S.,
F.R.S.S.Afr., Assistant Director. (With four Text-figures.)

This report contains descriptions of 6 new species of Terrestrial Isopods, all of which were obtained in Ovamboland during the course of the South African Museum expeditions. Only one previous author has dealt with the Woodlice of the South-West African region, namely, Budde-Lund in Schultze's *Forschungs Reise*. Budde-Lund recorded 7 species, so that the total now known, including a species listed but not named in this report, is 14.*

It is not surprising that so few species have yet been discovered. A large part of the region is probably too dry. On the other hand, Ovamboland, during the wet season, is frequently flooded to such an extent that these animals are in danger of being exterminated by drowning. For example, at one locality after heavy rain numbers of Woodlice were found clinging to grass-stalks projecting above the water of a "vlei" which would remain for a month or two. All these animals would undoubtedly have perished, and the area would have to be restocked from neighbouring unflooded areas.

Small as it is, the collection is interesting. *Periscyphops* and *Rhyscotus* are genera not hitherto recorded from any part of South Africa, and represent a southerly extension of a tropical element.

Family ONISCIDAE.

Gen. PERISCYPHOPS Hilg.

Periscyphops kunenensis n. sp.

Surface smooth, minutely granulate. Head continuous with epistome, which is slightly produced in a rounded convexity, but with a short keeled margin in front of eyes. Under side of 1st pereon

* Since this was in print the paper by Panning in Beitr. Kenntn. Land-Süssw. Fauna S.W. Afrikas (Hamburg) has come to hand. Panning records 12 further species. Two of these (*Deto echinata* and *acinosa*) are synonymous, so that the total number of species recorded for this region is 25.

segment with a slight ridge. Posterior angles of 5th pleon segment converging slightly. Telson with sides strongly concave, tapering to a narrowly rounded apex.

Second antenna with 5th joint $1\frac{1}{2}$ times 4th, flagellum with suture between 2nd and 3rd joints very obscure. Uropod with peduncle reaching to about same level as apex of telson, outer posterior angle shorter than inner, endopod reaching almost to apex of telson.

Size.— 8×2.75 mm.

Colour.—Dark slaty-grey, with or without a light spot laterally on each peraeon segment, but always with several smaller light spots arranged more or less in 2 rows dorsal to the position of the larger spots; first 3 joints of 2nd antennae, and the legs pale; uropods pale orange.

Locality.—Ovamboland: Kunene River, near Erikson's Drift (K. H. Barnard, 1923); Mafa, N. of Ondongua (R. F. Lawrence, 1923).

The larger lateral light spots are absent in the specimens from Mafa.

Gen. CUBARIS Brdt.

Cubaris ovampoensis n. sp.

(Text-fig. 1.)

Whole surface finely granulate, lateral rugae on peraeon segments moderately distinct. Epistome evenly convex above, concave below for the reception of 2nd antennae. Telson broader than long, apical

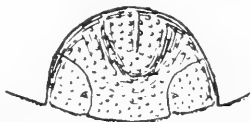


FIG. 1.—*Cubaris ovampoensis* n. sp. Telson and uropods.

margin straight, lateral margins concave, at base slightly gibbous with a short longitudinal median groove. Lateral margin of 1st peraeon segment grooved along its entire length; second segment with strong tooth internally.

Second antenna minutely scabrous, 2nd joint of flagellum nearly 3 times length of 1st. Uropod longer than broad, exopod.

Size.—Up to 6×2.5 mm.

Colour.—Slaty-grey, with lighter reticulation on head, and transverse rows of light lines laterally.

Locality.—Ovamboland: Namakunde (K. H. Barnard, 1923);

Kunene River, near Erikson's Drift (R. F. Lawrence, 1923) ; Ongandjera (R. F. Lawrence, 1923).

Cubaris (Diploexochus) quadrimaculatus B-L.

1909. Budde-Lund in Schultze, Forsch. Reise Südaf., vol. ii, p. 54, pl. v, figs. 1-7.

Locality.—Namaqualand : Keetmanshoop (Budde-Lund).

Cubaris (Diploexochus) longipes B-L.

1909. Budde-Lund in Schultze, Forsch. Reise Südaf., vol. ii, p. 55, pl. v, figs. 8-11.

Locality.—Damaraland : Okahandja (Budde-Lund).

Gen. NIAMBIA B-L.

Niambia pallida B-L.

1909. Budde-Lund in Schultze, Forsch. Reise Südaf., vol. ii, p. 61, pl. vi, figs. 26-28.

Locality.—Namaqualand : Kubub and Possession Island (Budde-Lund). Also in Little Namaqualand.

Niambia truncata (Brdt.).

1833. Brandt, Conspectus, p. 19.

1909. Budde-Lund in Schultze, Forsch. Reise Südaf., vol. ii, p. 60, pl. vi, figs. 4-14.

Locality.—Damaraland : Rooibank, near Walfish Bay (Budde-Lund). Also in Little Namaqualand and the Cape Province.

Niambia modesta B-L.

1909. Budde-Lund in Schultze, Forsch. Reise Südaf., vol. ii, p. 62, pl. vi, figs. 32-34.

Locality.—Damaraland : Grootfontein (Budde-Lund).

Niambia flavescens n. sp.

(Text-fig. 2.)

Surface with squamose setae. Ocelli ca. 10. Second antenna with 4th joint scarcely longer than 3rd. Pleura of 5th pleon segment extending beyond apex of telson. Telson much shorter than broad, lateral margins concave, dorsal surface concave. Exopod of 1st

pleopod in both ♂ and ♀ apically rounded and entire. Peduncle of uropod extending beyond posterior angle of pleurum of 5th pleon segment, exopod stout subequal to (but not longer than) peduncle, endopod reaching to end of peduncle.

Size.— 8×3 mm.

Colour.—Pale slaty-grey, with pale yellowish markings, antennae and legs pale.

Locality.—Ovamboland: Ondongua, Ongka, Namakunde, and Ukua-lonkathi (K. H. Barnard and R. F. Lawrence, 1923).

The following two species are typical members of the genus *Niambia*

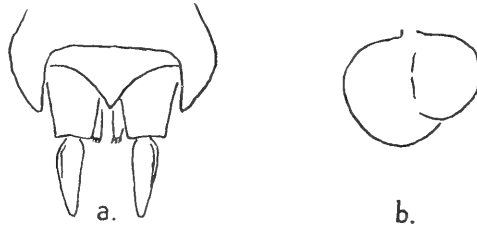


FIG. 2.—*Niambia flavescens* n. sp. *a*, telson and uropods; *b*, exopod of 1st pleopod ♂.

except that the spines on the outer branch of the 1st maxilla are all entire and not partly bifid. This seems a character of minor importance, but as it has been relied upon by Budde-Lund, I place these two species temporarily in *Niambia* pending a thorough investigation of the numerous *Niambia*-like forms found in South Africa, which I hope to undertake shortly.

Niambia (?) *griseo-flavus* n. sp.

(Text-fig. 3.)

Surface minutely granulate. Ocelli ca. 10. Second antenna with 4th joint scarcely longer than 3rd. Pleura of 5th pleon segment

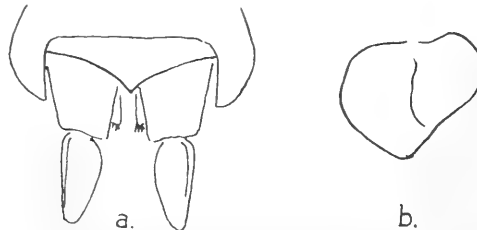


FIG. 3.—*Niambia* (?) *griseo-flavus* n. sp. *a*, telson and uropods; *b*, exopod of 1st pleopod ♂.

projecting considerably beyond apex of telson. Telson scarcely as long as broad, margins concave, dorsal surface concave. Exopod of 1st pleopod apically rounded and entire. Peduncle of uropod exceeding posterior angle of pleuron of 5th pleon segment, exopod stout, shorter than peduncle, endopod not reaching apex of peduncle.

Size.— 10×3.5 mm.

Colour.—Pale slaty-grey, with pale yellow markings, the yellow sometimes predominating on the head and peraeon, so that the animal appears quite light in colour, antennae and legs pale.

Locality.—Ovamboland: Andoni (K. H. Barnard, 1923).

Niambia (?) *longicauda* n. sp.

(Text-fig. 4.)

Surface minutely granulate. Ocelli ca. 10. Second antenna with 4th joint distinctly longer than 3rd. Pleura of 5th pleon segment shorter than apex of telson. Telson almost as long as broad, lateral

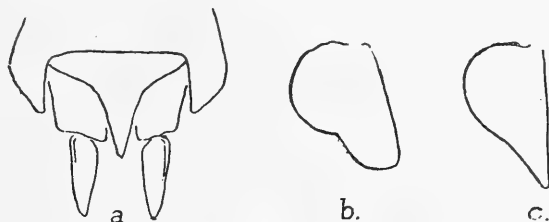


FIG. 4.—*Niambia* (?) *longicauda* n. sp. a, telson and uropods; b, exopod of 1st pleopod; c, of 2nd pleopod ♂.

margins strongly concave, tapering to an acute apex. Exopod of 1st pleopod apically rounded, outer margin excised. Peduncle of uropod extending almost to apex of telson, exopod stout, subequal to peduncle, endopod reaching apex of peduncle.

Size.— 5×2 mm.

Colour.—Slaty-grey, with pale markings, antennae and legs pale.

Locality.—Ovamboland: Andoni (K. H. Barnard, 1923); Damara-land: Sandup, between Otjikoto and Namutoni (K. H. Barnard, 1923).

Gen. RHYSCOTUS B-L.

Rhyscotus *bicolor* n. sp.

Surface regularly, but somewhat sparsely, granulate, including the epistome. Eyes with ca. 14 ocelli. Postero-lateral angles of peraeon

segments 1-3 rounded, of segments 4 and 5 subquadrate, of 6 and 7 acute. Telson short, margins rather strongly concave, apex acute. Second antenna with 5th joint distinctly but not greatly longer than 4th, flagellum equal to 4th joint. Ungues of peraeopods simple, without vesicle. Endopod of uropod only very slightly shorter than peduncle, exopod longer than peduncle.

Size.— 11×4 mm.

Colour.—Slaty-grey, head and peraeon obscurely marked with more or less longitudinal light spots, postero-lateral angles of peraeon segments and peduncle of uropod pale yellow, 1st and 2nd joints of 2nd antenna and the legs pale, pleopods grey, exopod of uropod grey or pale yellow.

Locality.—Ovamboland: Kunene River, near Erikson's Drift (K. H. Barnard, 1923); Ongandjera (R. F. Lawrence, 1923).

This species is very near to *R. globiceps* B-L. from the Congo, especially in the coloration, but differs in certain details.

Aphiloscia sp.

Specimens of a species of this genus were also obtained in Ovamboland, but are somewhat defective. I reserve the description of these until I can deal with the representatives from other parts of South Africa.

Family LIGIIDAE.

Gen. LIGIA.

Ligia dilatata Brdt.

1833. Brandt, Conspectus, p. 10.

1909. Budde-Lund in Schultze, Forsch. Reise Südaf., vol. ii, p. 64.

Locality.—Namaqualand: Lüderitz Bay (Budde-Lund). Also Cape Peninsula.

Family TYLIDAE.

Gen. TYLOS.

Tylos granulatus Krss.

1843. Krauss, Südaf. Crust., p. 64, pl. iv, fig. 5.

1909. Budde-Lund in Schultze, Forsch. Reise Südaf., vol. ii, p. 70.

Locality.—Namaqualand: Anichab, Lüderitz Bay and Prince of Wales Bay (Budde-Lund). Also on Cape Peninsula.

ANNALS

OF THE

SOUTH AFRICAN MUSEUM

VOLUME XX.

PART IV, containing:—

6. *The South African Species of the Molluscan Genus Onchidella.* By HUGH WATSON, M.A. (With Plates XXVII-XXXII, and one Text-figure.)
7. *Reports on the Marine Mollusca in the Collections of the South African Museum.* By J. R. LE B. TOMLIN, M.A.
I: *Turritellidae.* (With three Text-figures.)



ISSUED MARCH 1925. PRICE 10s.

PRINTED FOR THE
TRUSTEES OF THE SOUTH AFRICAN MUSEUM

BY NEILL AND CO., LTD.,
212 CAUSEWAYSIDE, EDINBURGH.

6. *The South African Species of the Molluscan Genus Onchidella.*

By HUGH WATSON, M.A.

(With Plates XXVII-XXXII and 1 Text-figure.)

CONTENTS.

	PAGE		PAGE
INTRODUCTION	238	DIGESTIVE SYSTEM	261
EXTERNAL FEATURES	239	Buccal Mass	261
Size	239	Buccal Retractors and Pro-	
General Form	240	tractors	264
Dorsal Surface	240	Jaw	265
Ventral Surface	241	Radula	266
STRUCTURE OF THE SKIN AND ITS		Salivary Glands	268
GLANDS	243	Oesophagus and Crop	269
Epidermis	243	Stomach and Intestine	270
Dermis	245	Liver	273
Marginal Glands	246	REPRODUCTIVE SYSTEM	274
Pedal Gland	247	Hermaphrodite Gland and Duct,	
LUNG, KIDNEY, AND PERICARDIUM	247	and Vesicula seminalis	274
Lung	249	Spermoviduct and adjacent	
Kidney	249	Glands	274
Ureter	250	Oviduct, Receptaculum seminis,	
Pericardium	251	and Vagina and its Gland	278
VASCULAR SYSTEM	252	Vas deferens and Penis	280
Heart	252	DIFFERENCES BETWEEN THE FORMS	
Arterial System	253	OF <i>Onchidella</i> FOUND AT THE	
Venous System	254	CAPE	282
NERVOUS SYSTEM	255	<i>Onchidella pulchella</i> , n. sp.	282
Cerebral Ganglia and Nerves	255	<i>Onchidella capensis</i> , n. sp.	283
Buccal Ganglia and Nerves	256	<i>Onchidella capensis</i> var. <i>pauci-</i>	
Pedal Ganglia and Nerves	257	<i>dentata</i> , n. var.	284
Pleural and Visceral Ganglia and		AFFINITIES BETWEEN THE SPECIES	
Nerves	257	OF <i>Onchidella</i> FOUND AT THE	
SENSE ORGANS	259	CAPE AND IN OTHER PARTS OF	
Tentacles, Eyes, and Labial Palps	259	THE WORLD	285
Otocysts	259	Mutual Relations of the Forms	
Oosphradium	259	found at the Cape and in South-	
VOL. XX, PART 4.		West Africa	285

	PAGE		PAGE
Resemblances and Differences between the Cape Species and those found elsewhere . . .	286	Factors determining Distribution	293
Dr. Dall's subdivision of <i>Onchidella</i>	290	Probable Causes of the Wide Distribution of <i>Onchidella</i> . .	295
GEOGRAPHICAL DISTRIBUTION OF THE GENUS	291	ALPHABETICAL LIST OF THE KNOWN SPECIES OF <i>Onchidella</i> , WITH REFERENCES	301
Misconceptions caused by Narrow Views on Distribution	291	EXPLANATION OF PLATES	305

INTRODUCTION.

THE genus *Onchidella* Gray* (= *Oncidiella* Fischer and Crosse†) includes several small slugs, which are found on the seashore, although there can be little doubt that they are correctly placed in the Pulmonata. The number of known species of *Onchidella* is not very great, but the genus has a remarkably wide geographical distribution, occurring in such distant regions as Cornwall, Tierra del Fuego, Alaska, and New Zealand. In 1882 Semper recorded the presence of the genus on the West Coast of Africa,‡ and in 1893 Plate described *Onchidella accrensensis* from the Gold Coast, and *O. maculata* from Angra Pequena, in what was then German South-West Africa.§ Hitherto, however, no species of *Onchidella* have been known to occur in the Cape Province. It is true that in 1878 Fischer and Crosse stated that "*Oncidiella marginata* Couthouy" was from "l'Afrique australe";|| but this was probably an error. As von Wissel has already remarked,¶ it is unlikely that this South American species occurs also in Africa, and both Collinge and Connolly omit *O. marginata* from their lists of the South African forms.** In 1900, however, some small slugs which Dr. Purcell had found at Green Point, near Cape Town, were identified by Collinge as *Onchidium peroni* Cuv., a member of a genus closely allied to *Onchidella*.††

* Fig. Moll. Anim., vol. iv, 1850, p. 117.

† Mission Scient. au Mexique et dans l'Amér. Centr., Zool., pt. 7, vol. i, 1878, p. 687.

‡ Reisen im Arch. der Philipp., pt. 2, vol. iii, p. 284.

§ Zoolog. Jahrb. (Anat. u. Ontog.), vol. vii, pp. 201, 203. It is possible that *O. pachyderma* Plate (*ibid.*, p. 204) is also a West African species, from Victoria in the Cameroons. (See Bretnall, Records of the Australian Museum, vol. xii, 1919, p. 328.)

|| *Op. cit.*, p. 696.

¶ Zoolog. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, p. 586.

** Ann. S. Afr. Mus., vol. ii, 1901, p. 235; vol. xi, 1912, p. 225.

†† *Ibid.*, vol. ii, 1900, p. 7.

Through the kindness of the late Dr. Péringuey and Dr. K. H. Barnard, and of Major M. Connolly, I have had the opportunity of examining, not only some of the specimens identified by Collinge, but also certain other slugs belonging to the Onchidiidae, collected by the late Mr. Lightfoot at St. James, False Bay, and by Dr. Barnard at Sea Point, near Cape Town, and in Buffels Bay, near Cape Point. Most of these specimens form a part of the collections of the South African Museum. All of them, including those found by the late Dr. Purcell, prove, on careful examination, undoubtedly to belong to the genus *Onchidella*. They appear, however, to constitute two new species, which differ in certain anatomical details from *O. maculata* and *O. accrensis* Plate, as well as from *O. marginata* (Couth. and Gould), and other species of which the anatomy has been described by von Wissel. One of the new species, which I am naming *Onchidella pulchella*, is represented only by the specimens found by Mr. Lightfoot at St. James. The other, to which I am giving the name *O. capensis*, comprises the specimens collected by Dr. Purcell and Dr. Barnard. The examples of this species from Buffels Bay, however, differ somewhat from those found nearer Cape Town, both in their external appearance and in their radula; and I am therefore placing these specimens in a distinct variety, which I am naming *O. capensis* var. *paucidentata*.

Although these two species can be easily distinguished from each other without any dissection, they are evidently very closely related forms, being remarkably similar in most of the features of their anatomy. Therefore, in order to avoid much needless repetition, it will be convenient to describe them together, and then to give a summary of those characters which separate the two species.

EXTERNAL FEATURES.

Size.—*Onchidella pulchella* and *O. capensis* are smaller than most members of the genus. Indeed, few naked Pulmonates known to science are smaller than *O. pulchella*, fully-grown spirit specimens of this species measuring only about 5·8 mm. in length, 3·6 mm. in breadth, and 2·5 mm. in height in the middle. The largest specimen of *O. capensis* that I have seen is one from Green Point, near Cape Town, which measures 7·5 mm. in length, 5·9 mm. in breadth, and 3·5 mm. in height. Specimens of this species from Sea Point are slightly smaller, though full-grown. The largest example of the variety *paucidentata* from Buffels Bay measures 5·8 mm. in length,

4.9 mm. in breadth, and 3.5 mm. in height, but it is somewhat contracted.

General Form.—Both species are oval in outline, rounded above and flattened beneath. *O. pulchella* is narrower, however, than *O. capensis*, as may be seen from the figures on Plate XXVII, and from the measurements given above. The back is strongly arched, especially in *O. capensis*. In the less contracted specimens, particularly of *O. pulchella*, the anterior end of the animal is higher in proportion to its breadth than is the posterior end; but the difference is not always as great as that which will be seen on comparing the figures of transverse sections near the anterior end on Plate XXIXA with those of sections near the posterior end on Plate XXXA.

Dorsal Surface (Plate XXVII, figs. 1, 2, 4, 5).—The entire dorsal surface is formed by the mantle, which extends over the whole of the back, including the top of the head. It bears numerous small papillae irregularly scattered over its surface. These papillae vary greatly in size, the larger ones having others between them so small that they can only be discerned under a strong lens. The larger papillae are better developed in *O. pulchella* than in *O. capensis*, where they are more flattened; but in the variety *paucidentata* from Buffels Bay they are rather more prominent than in typical specimens of *O. capensis* from near Cape Town.

Round the edge of the mantle there is a series of small swellings, which are much more prominent in *O. pulchella* than in *O. capensis*. These correspond to the large pallial glands to be described later. They are rather better developed towards the posterior end of the animal than in front. There are about 22 of these swellings in *O. pulchella* and about 24 in *O. capensis*. When the mantle-edge is contracted they stand out as short vertical ridges with grooves between them.

As in other species of *Onchidella*, there are no dorsal eyes, and, of course, no traces of a shell.

The upper surface of the mantle in *O. pulchella* is rather dark grey with white patches (in specimens preserved in spirit). There is always an irregular white band along the middle of the back, and an irregular white patch on the right side a little behind the centre of the animal, that is to say, over the region of the pericardium. Just above the edge of the mantle there is a series of short vertical white stripes, each corresponding to one of the marginal swellings which mark the position

of the large pallial glands. The apices of the larger dorsal papillae are also unpigmented, and there are usually a few additional small irregular white patches on the back, the number and position of which differ in every individual.

In *O. capensis* the upper surface of the mantle (in specimens preserved in spirit) is grey, generally of a rather dark shade, with very irregular, somewhat paler patches, chiefly situated towards the middle of the back. These lighter patches, however, are far less distinct than in *O. pulchella*, and are in some cases scarcely developed at all. The tops of the larger papillae are pale, but they are often surrounded by a dark ring. The marginal swellings are also of a pale colour, though the area of these unpigmented patches is smaller than in *O. pulchella*. In both species the extreme edge of the mantle is pale.

Ventral Surface (Plate XXVII, figs. 3, 6).—The foot, which occupies the whole of the central part of the ventral surface, measures about 4 by 2 mm. in *O. pulchella* and 4.5 by 2.5 mm. in *O. capensis*, in those specimens in which it is most expanded; but when it is in a contracted condition it is usually much shorter. It is truncated in front, and very bluntly pointed at the hinder end in both species. The sole is generally crossed by a number of irregular and ill-defined grooves. The sides of the foot are scarcely 0.5 mm. in height, and tend to slope outwards towards the lower edges, as may be seen from the sections (Plates XXIXB and c, figs. 40–44). The opening of the pedal gland is situated above the anterior end of the sole.

The head lies immediately in front of the foot, and bears on its lower surface a pair of broad labial palps. These lie somewhat obliquely, their outer ends being further back than their inner edges, which almost meet each other just in front of the mouth. They are seen in section in fig. 38 on Plate XXIXA. The mouth is situated relatively further back on the ventral surface of the head than in most Pulmonates. There is only a single pair of tentacles, which bear the eyes on their tips. They arise from each side of the very front of the head; but in preserved specimens they are usually retracted into the head, as shown in fig. 36, their position being indicated by a pair of openings. The opening of the penis is on the side of the head about 0.7 mm. behind the right tentacle in both species, and just above the outer edge of the right labial palp (Plate XXIXA, fig. 38).

The part of the lower surface which surrounds the foot and the head, and is known as the hyponotum, is flat, or even concave,

especially in *O. pulchella*, the mantle-edge forming an acute angle. It attains a breadth of about 1 mm. on each side in *O. pulchella* and of about 1.5 mm. in *O. capensis*. It is divided by a slight groove—the hyponotal line—into a broad outer part covered with minute papillae, and a narrow inner portion, about a quarter of the width of the outer part, and slightly more raised, but smooth without any papillae. Posteriorly the hyponotal lines of each side meet to form an angle behind the foot, the inner portion of the hyponotum being there broader in proportion to the outer papillated part (see Plate XXVII, figs. 3 and 6). On the other hand, in front of the head the smooth inner part disappears, the hyponotal line becoming confluent with the groove which separates the anterior surface of the head from the hyponotum in front of it. While the outer part of the hyponotum should probably be regarded as the under surface of the mantle-edge, it is perhaps possible that the inner portion corresponds to the sides of the body in the majority of Pulmonates.

The opening of the mantle-cavity or lung is situated in the posterior angle formed by the hyponotal line, and is about 0.6 mm. from the edge of the mantle in *O. pulchella* and about 0.7 mm. in *O. capensis*. The anus or opening of the cloaca is also in the middle line; it is 0.5 mm. in front of the opening of the lung, and is partly hidden by the posterior extremity of the foot. The female genital opening is obliquely in front and to the right of the anus, but close beside it. Both of these openings are situated in the posterior end of a well-marked ciliated groove, which begins in the middle line just behind the head and a little in front of the opening of the pedal gland, and passes at first outwards to the right and then backwards close to the inner edge of the hyponotum, beside the angle formed by the union of the hyponotum with the right side of the foot, until it eventually reaches the female genital opening and the anus at the hinder end of the animal. This groove is almost completely hidden by the edge of the foot, but it is shown in section in fig. 60 on Plate XXXI. It is bounded outwardly by a slight ridge, and its lining is usually thrown into narrow longitudinal folds. No corresponding ciliated groove is present on the left side of the animal.

This groove occurs also in related forms, and was at one time thought to serve the purpose of a vas deferens, as is the case with a similar groove in certain more primitive groups.* But a separate vas deferens exists embedded in the skin, the presence of which in

* Fischer and Crosse, for example, held this view (Mission Scient. au Mexique et dans l'Amér. Centr., pt. 7, vol. i, 1878, p. 689).

O. celtica (Cuv.*) was demonstrated by Joyeux-Laffuie forty years ago,† and which we shall see also occurs in the South African species. Plate has therefore suggested that this groove is retained by these slugs in order to serve on occasion for the conveyance of spermatozoa from the penis to the vagina for the purpose of self-fertilisation.‡ While there is much to be said in favour of this suggestion, it should be emphasised that the groove does not begin in or near the opening of the penis, on the right side of the head, but in the middle between the mouth and the opening of the pedal gland, although its anterior end is doubtless within reach of the penis when that organ is fully exerted.

The hyponotum is of a uniform pale whitish colour in *O. pulchella* and in *O. capensis* var. *paucidentata*; but in the typical form of *O. capensis*, while the greater part of the hyponotum is unpigmented, the hinder end beside the opening of the lung is of a grey colour. The foot is slightly tinged with yellow, especially in *O. capensis*. The head is more or less tinged with grey in both species.

STRUCTURE OF THE SKIN AND ITS GLANDS.

Epidermis.—The mantle is covered by a compact epithelium of rather deeply staining columnar cells, which measure about 0.013 mm. in height by 0.005 mm. in breadth, unless the skin is stretched out, when they become shorter and broader. Their nuclei are situated towards their inner ends, which are bluntly pointed. Their outer ends are distinctly convex, and are covered by a moderately thick cuticle, which is accordingly thrown into a multitude of minute convexities, each corresponding to a single epidermal cell.

Scattered among these epithelial cells of the mantle other clear cells occur, either singly or in small circular groups of five, ten, or even more individual cells, the groups occurring chiefly on the apices

* Although I am following the usual custom of ascribing this name simply to Cuvier, it might perhaps be more correct to write it thus: *O. celtica* ((Cuv.) Audouin and Milne-Edwards). For while Cuvier named the species as early as 1817 (*Règne Animal*, vol. ii, p. 411), he does not seem to have described it; and it was not until 1832 that Audouin and Milne-Edwards published an account of the habits of this species together with a very brief description of its external appearance (*Recherches Hist. Natur. du Littoral de la France*, vol. i, p. 118). Dall, however, ascribes the name to Forbes and Hanley (*Alaska*, vol. xiii, 1905, p. 112), although these authors ascribe it to Couch (*Hist. Brit. Moll.*, vol. iv, 1853, p. 3).

† *Arch. de Zoologie Expér. et Génér.*, vol. x, 1882, p. 527.

‡ *Zoolog. Jahrb. (Anat. u. Ontog.)*, vol. vii, 1893, p. 99.

of the smaller papillae. These are the cells which Joyeux-Laffuie has termed "special epithelial cells" in *Onchidella celtica* (Cuv.).* They are larger than the ordinary epidermal cells described above, and are most often narrowly pear-shaped, their inner ends being the broadest. They have basal nuclei, and the remainder of the cell is uncoloured by such stains as haematoxylin or borax-carmin. When they occur in groups, the individual cells are separated by narrow supporting cells; but the cuticle covering the group is flat, instead of being raised into the usual little convexities.

These special epithelial cells are probably of the nature of unicellular glands, as suggested by Joyeux-Laffuie and von Wissel,† although in sections no pores are visible in the overlying cuticle. The view that in this genus they form visual organs, even of the most rudimentary character, is rendered very improbable not only by their structure but also by their occurrence in unpigmented as well as in pigmented areas of the skin and on the hyponotum as well as on the back, and by the fact that no nerves can be traced to them. It might be suggested, however, that these cells may possibly play some part in connection with the oxidation of the blood in the small veins that lie beneath them, for there can be no doubt that the mantle forms the respiratory organ of these slugs when the animals are under water.

The epidermis of the broad outer part of the hyponotum is very similar to that of the upper surface of the mantle, although the groups of special epithelial cells may not always be quite so conspicuous. On the other hand, the epidermis of the part of the hyponotum within the hyponotal line is composed of rather smaller cells, with a flat cuticle and nuclei which stain more deeply in comparison with the cytoplasm. The epithelial cells lining the groove near the right side of the foot are strongly ciliate, the cilia measuring about 0.003 mm. in length in both of the species found at the Cape (Plate XXXI, fig. 60).

The foot-sole is covered with slightly shorter cilia, borne by narrow cells, which vary somewhat in length, and usually touch one another only at their outer ends, their inner ends being irregularly pointed.

The front of the head has a well-defined epidermis of short columnar cells, which measure about 0.01 mm. in length by 0.005 mm. in breadth. The cells composing the epidermis of the labial palps are longer and narrower, with elongated basal nuclei.

* Arch. de Zoologie Expér. et Génér., vol. x, 1882, p. 293, pl. xvi, fig. 9.

† Zoolog. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, p. 495.

Dermis.—The body-wall is very thick at the sides of the animal, but becomes gradually thinner towards the middle of the back, where it is 0.07 mm. thick in *Onchidella pulchella* and about 0.06 mm. in *O. capensis*. (See Plates XXIX and XXX.)

Beneath the epidermis of the mantle the body-wall may be said to be formed of two layers: a broad outer layer, consisting of a rather close network of muscle fibres passing in various directions and enclosing numerous connective-tissue cells, etc., and a much thinner layer immediately surrounding the body-cavity, consisting almost entirely of muscle fibres passing round the animal in a circular direction. But these two layers merge imperceptibly into each other, especially on the back; laterally they are separated by an ill-defined area of looser, more open connective tissue and fibres, which occupies the centre of the thickest part of the body-wall in the angle between the hyponotum and the sides of the back. The structure of the body-wall is thus rather different from that of *Onchidella marginata* (Couth. and Gould) and *O. coquimbensis* Plate, as described by von Wissel.*

The dorsal body-wall also contains, in addition to blood-vessels, etc., small irregular grains of dark pigment, which occur in a layer, of an average thickness of about 0.02 mm., situated immediately below the epidermis, except that it crosses the bases of the larger papillae (Plate XXXB, fig. 51). In those areas of the back which are of a dark colour these pigment grains just below the epidermis are very abundant, but in the pale areas only a few very minute scattered grains occur. None were found actually between the epidermal cells, although von Wissel states that they occur there in the South American species which he examined.† Unlike *O. celtica* (Cuv.), the inner surface of the body-wall is unpigmented in both the species from the Cape; but in *O. capensis*, where the body-wall is thinnest, it usually has a greyish appearance, owing to the pigment in the outer layer of the dermis showing through the underlying tissue.

The foot is also mainly composed of muscle-fibres passing in various directions and intermingled with connective-tissue cells. In the upper part, near the body-cavity, muscles passing from left to right predominate; near the sole vertical fibres are relatively more numerous; but the structure of all the lower part of the foot is very open, unless the organ is much contracted, numerous blood-lacunae being present between the cells (Plate XXXB, fig. 52). Small unicellular glands occur

* Zoolog. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, p. 591.

† *Ibid.*, p. 592.

near the sole, just above the epidermis. Nearer the centre of the foot are scattered small rounded masses of minute granules, often tinged with brown, and possibly of a calcareous nature, resembling the granules that are found abundantly in the liver.

Marginal Glands.—Large multicellular glands occur deeply embedded in the thick marginal part of the mantle, and discharge by ducts which open on the mantle-edge (Plate XXIXA–XXXB, figs. 36–42, 44–47, 49, 50). They are pear-shaped in form, the stalk of the pear representing the duct of the gland. There are about eleven of these glands on each side in *Onchidella pulchella* and about twelve in *O. capensis*. In both species they attain a diameter of 0.33 mm., except at the front end over the head, where they do not exceed 0.25 mm. in diameter.

Each gland is surrounded by a well-marked layer of circular muscles, and consists mainly of large thick-walled gland-cells radiating from the inner end of the duct. The protoplasm in each gland-cell is chiefly confined to a layer lining the outer end of the cell, where the large oval nucleus is situated, containing a distinct nucleolus. These gland-cells are often very large, and in them the major diameter of the nucleus may be no less than 0.025 mm. The remainder of the interior of the gland-cells is more or less filled with secretion, some of which is compact and becomes coloured with haematoxylin or carmine, while some has a more granular appearance and is not affected by these stains. But every gradation is found between these two forms of the secretion, which very often occur together in the same cell, merging into each other; and in this case the compact form does not invariably occupy the part of the cell nearest to the duct, as von Wissel found to be the case in the South American species.* Slender supporting cells with narrow nuclei are present between the gland-cells, where there are also, as a rule, a few scattered grains of pigment.

The duct of the gland possesses a distinct epithelium, and towards the inner end of the duct the small epithelial cells are seen to be each prolonged into a single rather large cilium or flagellum. Surrounding this part of the duct, in the centre of the broad part of the gland, there is another layer of circular muscles, slightly thinner than that which lies outside the gland-cells. As the duct is followed outwards the gland-cells surrounding it become rapidly fewer and much smaller, but some of these small gland-cells accompany the duct for at least

* *Op. cit.*, p. 595.

two-thirds of its length, only the last part of the duct, next to its external opening, being destitute of glandular tissue.

From the above account it will be seen that the marginal glands of the South African species here described bear a fairly close resemblance to those of *Onchidella marginata* (Couth. and Gould) and *O. juan-fernandeziana* Wiss. figured by von Wissel.* There can be little doubt that they are defensive in character, but it is scarcely possible to say whether they are true "poison-glands" merely from an examination of preserved specimens.

Onchidella pulchella and *O. capensis* do not seem to possess the rather large glands which open on the hyponotum in certain species of *Onchidella*, nor those which Pelseneer describes as opening on the labial palps in *O. patelloides* (Q. and G.).†

Pedal Gland.—The anterior pedal gland is of a short and simple form. It opens, as usual, above the front end of the foot, but its upper and hinder parts lie freely in the body-cavity beneath the central nervous system (Plate XXIXB, fig. 40). The deeply-staining gland cells, of which it is mainly composed, are grouped into rather irregular, but compact, clusters or masses of glandular tissue. The central duct of the gland is comparatively short and very broad, measuring in *O. pulchella* 0.33 mm. in width by 0.1 to 0.15 mm. in height towards its anterior end. The roof of the duct is flat, or even a little convex; the lateral walls are very low; the floor is slightly concave, especially along the middle of the anterior end, where the duct might be described as broadly hexagonal in transverse section. The walls of the duct are without any folds, but a few short and ill-defined subsidiary channels seem to lead from the outer dorsal angles of the duct into some of the larger masses of gland-cells. The duct has a distinct epithelium, which, however, is more compact on its roof than on its floor. Both the gland-cells and the duct are largely filled with a vesicular secretion, which stains intensively with haematoxylin and renders the more minute structure of the gland difficult to make out in detail.

LUNG, KIDNEY, AND PERICARDIUM.

Round the posterior third of the animal, reaching forward to the pericardium on the right side and to about the same level on the left,

* *Op. cit.*, pl. xxxiv, figs. 7, 8.

† Mém. de l'Acad. Roy. de Belg., vol. liv, 1901, "Études sur des Gastropodes Pulmonés," p. 20, pl. v, fig. 45.

there lies a cavity or series of cavities, which is separated from the main body-cavity by a muscular diaphragm, and opens to the exterior by the orifice in the hyponotum nearest to the posterior extremity of the animal (Plates XXXA and B, figs. 45-50).

This cavity is known to occur also in other members of the family Onchidiidae, but its nature has been the subject of much controversy. Some authors, such as Hancock,* Vaillant,† and Fischer and Crosse,‡ have followed Cuvier § in regarding it simply as a lung. On the other hand, Milne-Edwards,|| von Jhering,¶ Joyeux-Laffaie,** and Brock †† maintained that it was a kidney, which, however, might occasionally be used for respiration; Joyeux-Laffaie in particular arguing at some length that *Onchidella* has no true lung. Haller ‡‡ also denies the existence of a lung, but confidently asserts that the cavity in question consists of a pair of kidneys united only by the terminal portions of their ducts. Semper §§ and Bergh ||| take the view that a kidney and a lung are both present, the two organs being distinct though adjacent and communicating with each other. Lastly, Plate, ¶¶ von Wissel,*** Pelseneer,††† and Stantschinsky‡‡‡ also consider that these slugs have both a kidney and a true lung, but they maintain that there is no actual communication between the two organs, the kidney opening into the rectum by means of a short ureter and not into the lung.

From the following description it will be seen that the anatomy of the South African species of *Onchidella* is in accord with this last

* Forbes and Hanley, Hist. British Mollusca, vol. iv, 1853, p. 4.

† Comptes Rendus Acad. Sci. Paris, vol. lxxiii, 1871, p. 1173.

‡ Mission Scient. au Mexique et dans l'Amér. Centr., pt. 7, vol. i, 1878, p. 691.

§ Ann. du Mus. Nat. d'Hist. Natur. Paris, vol. v, 1804, pp. 40-42.

|| Leçons sur la Physiol. et l'Anat. Compar., vol. ii, 1857, pp. 90, 91; vol. vii, 1862, p. 382.

¶ Sitz.-ber. d. Phys.-Med. Soc. z. Erlangen, vol. ix, 1877, pp. 131-168.

** Arch. de Zoologie Expér. et Génér., vol. x, 1882, pp. 274-289.

†† Biol. Centrabl., vol. iii, 1883, pp. 370-374.

‡‡ Verhandl. Naturhist.-Medicin. Vereins Heidelberg, vol. v, 1894, pp. 301-310.

§§ Arb. a. d. Zool.-Zoot. Inst. Würzburg., vol. iii, 1877, pp. 480-488; Reisen im Arch. der Philipp., pt. 2, vol. iii, 1880, p. 253.

||| "Challenger" Reports, Zoology, vol. x, 1884, Report on the Nudibranchiata, p. 127; Morphol. Jahrb., vol. x, 1884, pp. 179-181; Ann. Mag. Nat. Hist., ser. 5, vol. xiv, 1884, p. 265, 266.

¶¶ Verhandl. d. Deutsch. Zoolog. Gesells., 1892, p. 33; Zoolog. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, pp. 122-133.

*** Zoolog. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, pp. 607-622.

††† Mém. de l'Acad. Roy. de Belg., vol. liv, 1901, *op. cit.*, p. 22.

‡‡‡ Zoolog. Jahrb. (Syst., Geogr. u. Biol.), vol. xxv, 1907, pp. 361-364.

view, which may be accepted as the correct interpretation of the organs in question.

Lung.—The true mantle-cavity or lung is crescentic in form, its median portion being situated above and slightly in front of its external opening in the posterior end of the hyponotum, with which it is connected by a short channel (Plate XXXA, fig. 45).^{*} From this region it extends forwards on each side for about $1\frac{3}{4}$ mm., but its cavity is restricted and irregular in shape owing to the sides of the kidney projecting into it. On the right side the lung is divided by the kidney into two branches, an upper one, and a lower, more laterally situated portion, both parts extending as far forwards as the posterior end of the pericardium (see figs. 45–50). The portion of the lung on the left side of the animal extends forwards for about the same distance, and is narrow but undivided, being situated above and to the left of the kidney.

The outer walls of the lung and the roof of its posterior part are lined by a network of rather broad low folds, thus increasing the respiratory surface. This network of folds is apparently rather coarser in *Onchidella pulchella* than in *O. capensis*. The connective tissue in and around these folds contains the pulmonary veins, and sometimes also small masses of granules, like those occurring in the middle of the foot. The lung is lined throughout by a pavement epithelium of very thin cells with flattened nuclei. The short channel, however, which leads to the external opening, is lined by a ciliated columnar epithelium.

Kidney.—The kidney is rather capacious, and projects boldly into the lung throughout the entire length of that organ, as may be seen from the transverse sections shown in figs. 45–50. Its broadest part is situated on the right side just behind the pericardium (fig. 48). From this region a ventral prolongation of the kidney extends forwards beneath the pericardium for a short distance (fig. 50). Passing backwards the kidney divides into an upper and a lower portion (figs. 46, 47). The lower branch extends along the floor of the lung nearly to its hinder end, gradually tapering as it does so, and ending blindly about as far back as the level of the anus. The upper portion is larger, and is the part of the kidney that divides the lung on the right side into two branches. It extends back to the posterior end

^{*} The exact position of the external opening of the lung has already been described on p. 242.

of the mantle-cavity, where it curves down and goes obliquely across towards the left just behind the opening of the lung, becoming narrower as it does so (fig. 45). It then broadens again and passes forwards on the left side of the animal, occupying all the lower part of the mantle-cavity on that side (figs. 45-49). The kidney, however, extends forwards considerably further than the lung on the left side, and further even than the anterior prolongation of the kidney beneath the pericardium on the right side, although not as far as a point that would be opposite to the anterior extremity of the pericardium itself (Plate XXIX_C, figs. 43, 44; Plate XXX_B, fig. 50).

It will be seen from this description that the form of the kidney in the Cape species of *Onchidella* closely resembles that found by Plate in *O. maculata* *; and, as in that species, its cavity is unusually spacious, although the walls are furnished internally with a few narrow irregular folds.

The kidney is lined by an epithelium of characteristic excretory cells (Plate XXX_B, fig. 53). The protoplasm is confined to the basal half of each cell, where the rather large rounded nucleus is situated, except that a very thin layer of protoplasm usually extends along nearly the whole length of the cell's lateral walls. The remainder of the cell next to the cavity of the kidney is clear, but frequently contains a globule or concretion, which stains extremely faintly, but is, on an average, of about the same size as the nucleus. The cells are perhaps most usually of the form and size shown in fig. 53; but in some places they may be broader and shorter, while in others, especially on the folds, they are longer and narrower. The kidney is lined by only a single layer of these cells, although, if the epithelium be cut very obliquely, it may present the appearance of being formed of several layers as depicted by Joyeux-Laffuie.† In view of the striking contrast between this renal epithelium and the pavement epithelium of the lung, it is somewhat remarkable that Haller and others should have failed to distinguish between the lung and the kidney in this genus.

Ureter.—At the hinder end of the left half of the kidney, close to the place where the right half passes into it, its ventral wall is produced into a hollow papilla, ending in a small opening. This papilla projects into the end of the ureter, which is a rather broad duct embedded in the upper surface of the hyponotal body-wall, and usually measur-

* Zoolog. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, pl. ix, figs. 43, 44; pl. x, figs. 45-49.

† Arch. de Zoologie Expér. et Génér., vol. x, 1882, pl. xvi, fig. 3.

ing about 0.3 mm. in length and about 0.12 mm. in diameter. The ureter passes obliquely forwards and to the right to open by a rather narrow orifice into the left side of the rectum about 0.5 mm. from the anus, thus converting the end of the alimentary canal into a cloaca. The papilla of the kidney is flattened in such a way as to stretch horizontally across the lumen of the ureter, and thus divides its initial portion into two pockets, one above the other (Plate XXXA, fig. 45).

The excretory epithelium lining the kidney does not extend into the ventral papilla, but is replaced there by an epithelium composed of smaller, somewhat flattened cells. The ureter itself is lined by epithelial cells which are more or less cubical in form, but they become higher and more columnar around the opening of the ureter into the rectum.

Pericardium.—The pericardium is situated on the right side of the animal, a little behind the middle of its length. It is an oval sac, about a millimetre long, and is lined by a pavement epithelium of thin cells with slightly flattened nuclei, a little like the epithelium of the lung. The posterior half of the pericardium projects into the front end of the mantle-cavity on the right side of the animal, being separated from the main body-cavity or haemocoel by the muscular diaphragm (Plate XXXB, figs. 49, 50). The anterior half, on the other hand, may be regarded as lying in the right side of the body-cavity, from which it is only separated by its thin membranous wall (Plate XXIXC, figs. 43, 44).

In one of the two specimens of *Onchidella pulchella* cut into sections it was found that the pressure of the internal organs had pushed outwards and backwards the thin wall dividing the body-cavity from the anterior part of the pericardium, the ventricle of the heart being displaced outwards and considerably flattened, and a large part of the space usually occupied by the anterior half of the pericardium being filled with parts of the reproductive organs and liver. This must have seriously affected the free action of the heart; and it may be suggested that one of the reasons why the pericardium in most Pulmonates has come to lie almost entirely in the roof of the mantle-cavity is to prevent the occurrence of this condition when the pressure in the body-cavity is increased owing to the full development of the reproductive organs.

The hinder extremity of the pericardium, to the right of and slightly below its centre, is produced into a ciliated funnel or duct, which projects backwards and towards the left into the broad part of the kidney.

This is the reno-pericardial canal. It is rather long, but its lumen and terminal opening are very narrow, and it might perhaps be mistaken for one of the folds which project into the cavity of the kidney, an error which Joyeux-Laffuie probably made when he failed to find a reno-pericardial canal in the adult form of *Onchidella celtica* (Cuv.).*

It will be seen from the description just given that the pericardium of these slugs communicates with the exterior by way of the kidney, the ureter, and the terminal portion of the rectum. The kidney of

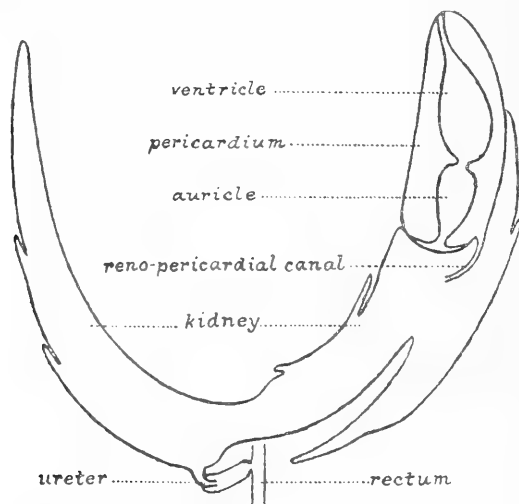


Diagram showing the relations of the kidney with the pericardium and the rectum.

Onchidella may therefore be correctly regarded as an unpaired renal coelomduct, which arises from the pericardium, extends throughout the whole length of the mantle-cavity, but discharges into the rectum by means of a short ureter. Possibly the mutual relations of these organs may be made clearer by the accompanying simplified diagram.

VASCULAR SYSTEM.

Heart.—When viewed from the body-cavity, the ventricle of the heart can be seen through the thin inner wall of the anterior half of the pericardium, within which the ventricle lies (Plate XXVII, fig. 7; Plate XXIXc, fig. 44). The auricle, on the other hand, is hidden by the anterior part of the diaphragm, as it is situated towards the

* *Op. cit.*, pp. 259, 288.

hinder end of the pericardium, the Onchidiidae being one of the very few families of the Pulmonata in which the auricle of the heart is behind the ventricle (Plate XXXB, figs. 49, 50).

The ventricle is ovately pyriform and very muscular, its interior being largely occupied by numerous bundles of muscle-fibres passing in various directions. Two bands of muscle lie one on each side of the narrow opening leading into the auricle, and doubtless constitute an auriculo-ventricular valve.

The auricle in the specimens examined was smaller than the ventricle, with much folded walls, owing to its being in a contracted state. Its walls are thinner than those of the ventricle, although it also contains some muscular strands projecting into its cavity, the "tendinous cords, of which the aspect is agreeable to the eye," discovered by Cuvier in the auricle of *Onchidium peronii* more than a hundred years ago.* The largest of these muscular strands, instead of merely passing from one part of the wall of the auricle to another, arises far back in the mantle-cavity and passes forwards into the auricle inside the outer or chief pulmonary vein (Plate XXXB, fig. 53). A smaller and shorter muscular strand enters the auricle through the inner pulmonary vein.

Arterial System.—A large aorta arises from the front end of the ventricle and passes forwards through the wall of the pericardium into the body-cavity. It then bends inwards to pass through the loop formed by the intestine (Plate XXIXC, fig. 42), giving off as it does so a large branch to the left, the so-called visceral artery, which supplies blood to the stomach, liver, etc. (figs. 43, 44). Having curved round the left side of the intestine, the aorta again approaches the body-wall and gives off another important branch, the genital artery, which passes backwards along the right side of the floor of the body-cavity to supply the organs near the hinder end of the animal. The aorta then runs forwards beneath the right side of the crop, to which it gives off a small artery.

On approaching the central nervous system the aorta curves to the left towards it, obliquely crossing the posterior extremity of the right pleuro-parietal ganglion, and then bending down beneath the connective uniting this ganglion with the abdominal ganglion. It passes over both the pedal commissures, but near the anterior one it gives off a branch which bends round the front of this commissure and runs backwards on the floor of the body-cavity, supplying arterial blood

* Ann. Mus. Nat. d'Hist. Natur. Paris, vol. v, 1804, p. 43.

to the pedal gland and the foot. A little further forwards the aorta divides into three arteries,—two parietal arteries which pass outwards and then forwards, one on each side, to supply the lips, etc., and a median odontophoral artery which passes above the subcerebral commissure and bends upwards to the ventral surface of the buccal mass, where it divides into two branches, one passing forwards and the other backwards (Plate XXIXB, fig. 39).

Owing to the condition of the material available for examination it was not possible to make out the details of all the smaller branches of the arteries; and although it is believed that all the information given here concerning the vascular system applies equally to both of the Cape species of *Onchidella*, some of the finer points were only clearly seen in the case of *O. pulchella*.

The aorta and the principal arteries are surrounded by a thick layer of vacuolated tissue, within which there is a thin layer of muscle-fibres (Plate XXVIII, fig. 32; Plates XXIXB and C, figs. 41, 42). The calcareous granules, which Joyeux-Laffuie found so abundantly in the walls of the arteries of *Onchidella celtica* (Cuv.),* did not occur in the specimens examined; although they may possibly have been present when the animals were alive.

Venous System.—The body-cavity, being a haemocoel, constitutes the largest part of the venous system. The foot contains within its substance numerous irregular blood-lacunae, opening into one another, and communicating with the body-cavity by means of occasional pores, one of which is seen in section in fig. 41. But the chief median sinus is less well defined in the South African species than it appears to be in *O. celtica*, according to the description and figures of Joyeux-Laffuie.†

There is, however, a well-marked lateral sinus on each side, near the inner surface of the thickest part of the body-wall (Plates XXIXA–C, figs. 38–43). These communicate with the body-cavity by means of two rows of transverse slits, which can be seen from within piercing the circular muscles that form the inner layer of the body-wall on each side. Each lateral sinus extends backwards to the kidney, the right one passing below the pericardium (fig. 44). It seems possible that the considerable forward extension of the kidney on the left side of the animal may have been partly due to the presence of the large lateral sinus in front of it, not only in order to facilitate the purifica-

* Arch. de Zool. Expér. et Génér., vol. x, 1882, pp. 260, 261, pl. xv, fig. 5.

† *Ibid.*, pp. 267, 268, pl. xv, figs. 1, 2.

tion of the blood in the sinus, but also because its cavity would provide room for the enlargement of the kidney in that direction, without further encroaching upon the limited space in the lung.

Numerous branches are given off by each lateral sinus into the mantle, and these seem to form a network of small veins just below the epidermis, which doubtless serve for respiration, especially when the animal is under water and the opening of the lung is closed. From these small veins the blood seems to pass into a longitudinal vein on each side lying in the body-wall dorsal to the lateral sinus (Plates XXIX_B and c, figs. 40–44). The vein on the left side passes backwards to the walls of the lung; that on the right extends past the outer side of the pericardium as far as its hinder end, and then unites with the posterior extremity of the auricle. At the same place two other veins open into the auricle, bringing blood forwards from the walls of the lung and kidney. The larger of these two pulmonary veins lies towards the outer side of the mantle-cavity, in a line with the right lateral vein just mentioned, and it may be regarded as a continuation of the left lateral vein, after the latter has passed round the posterior wall of the lung. The smaller vein from the lung and kidney comes from the upper part of the mantle-cavity, and opens into the posterior extremity of the auricle on its inner or left side.

NERVOUS SYSTEM.

Cerebral Ganglia and Nerves.—With the exception of the buccal ganglia, the central nervous system is concentrated into a group of seven ganglia lying between the pedal gland and the posterior end of the buccal mass (Plate XXVII, fig. 10; Plate XXIX_B, figs. 39, 40). Of these ganglia the cerebral are the largest and most dorsally situated, although they do not lie above the oesophagus but on each side of it. They are slightly broader than long, and often attain a maximum diameter of 0.4 mm.

The lateral lobe of each cerebral ganglion is well developed and rounded in form. It is mainly composed of cells containing rather small nuclei uniform in size; whereas in the remainder of the ganglion the nuclei vary greatly in size, and are situated almost exclusively near the surface, as may be seen from Plate XXXI, fig. 62. This photomicrograph also illustrates the fact that each of the two lateral lobes contains near its outer surface a hollow vesicle, surrounded by a distinct epithelium. The cavity of the vesicle measures, in *Onchidella pulchella*, 0.02 mm. in its greatest diameter parallel to the surface of the lobe, by a little more than 0.01 mm. in a direction at right angles

to the surface. The epithelium is thickest on the outer side of the vesicle, where the cells are columnar in form and have very little space between their nuclei. The occurrence of this vesicle in the lateral lobe of each of the cerebral ganglia of *Onchidella* is of special interest, although a similar vesicle has already been found in certain fresh-water Basommatophora,* as well as in the embryos of some Stylommatophora.

The cerebral ganglia are united above the oesophagus by a thick arched cerebral commissure. Below they are joined by a much narrower subcerebral commissure, which, however, is better developed than in most Stylommatophora. It appears to give off at least one pair of small nerves, and passes beneath the oesophagus and the odontophoral artery, but above and in front of the pedal and parietal arteries. The origin of both commissures is shown in fig. 62, but their form will be best seen from Plate XXVII, fig. 10.

The usual cephalic nerves to the sense-organs, etc., originate from the cerebral ganglia, the largest being the pair of nerves to the tentacles and eyes and the pair to the labial palps. The former arise from the anterior upper surface of the ganglia; the latter from the outer surface below the lateral lobe. So far as it was possible to see in the case of such small species, the distribution of the minor nerves does not differ materially from that described by Plate in the larger members of the family Onchidiidae.†

Buccal Ganglia and Nerves.—The stomato-gastric or buccal ganglia are situated on the top of the buccal mass just behind the opening of the oesophagus (Plate XXIXA, fig. 37), and are united to the cerebral ganglia by long and rather slender cerebro-buccal connectives (Plate XXVII, fig. 10), which are more or less embedded in the outer muscular layers of the buccal mass towards their upper anterior ends. The ganglia are transversely oval, their greatest breadth being about 0.2 mm. in *Onchidella capensis*, and slightly less in *O. pulchella*. They are united behind the opening of the oesophagus by a buccal commissure, which is of about the same length as the breadth of either ganglion.

Each buccal ganglion gives off close to its outer end a nerve which soon divides into two branches, the larger going to the oesophagus and the smaller one to the salivary gland on that side. The nerves from the buccal ganglia to the sides of the buccal mass are united for

* Pelseneer, Mém. de l'Acad. Roy. de Belg., vol. liv, 1901, "Études sur des Gastropodes Pulmonés," p. 35, pl. vii, figs. 57-60; pl. ix, fig. 77.

† Zoolog. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 153, pl. xii, fig. 85.

varying distances with the cerebro-buccal connectives; the largest and most anterior pair separate from the connectives about 0.1 mm. from the outer ends of the ganglia, but other pairs of nerves pass off from the connectives into the odontophoral muscles further back (Plate XXVII, fig. 10). A pair of very slender buccal nerves arises from the inner ends of the ganglia where they pass into the buccal commissure; but the principal pair of odontophoral nerves arises from the centre of the commissure as a single large nerve, which passes backwards and then divides into a right and a left branch.

Pedal Ganglia and Nerves.—The pedal ganglia are oval in form, and are slightly smaller than the cerebral ganglia, being about 0.35 mm. long by scarcely 0.25 mm. broad. The two ganglia do not appear to differ in size, but in the specimens examined the right ganglion was slightly further back than the left (Plate XXVII, figs. 9, 10). They are united to the cerebral ganglia by unusually short cerebro-pedal connectives, and yet they lie closer together than do the pedal ganglia of many of the Onchidiidae. They are united to each other by two pedal commissures—a broad, very short one towards the anterior ends of the ganglia, and a narrow, longer commissure which connects their hinder extremities.

The pedal nerves can be divided, as usual, into lateral nerves and ventral nerves. Three lateral nerves arise from each pedal ganglion—(1) a slender one from the anterior extremity of the ganglion, near the end of the cerebro-pedal connective; (2) a larger nerve from the outer side of the ganglion slightly further back, not far from the end of the pleuro-pedal connective; and (3) another slender nerve from nearly half-way along the outer side of the ganglion. The large ventral nerves to the foot-sole are given off from the lower surface of the ganglia, and also arise from three pairs of roots—the first pair from a little in front of the middle of the ventral surface of the ganglia, the second from a little behind the middle, and the third pair, which is perhaps the largest, from the posterior ends of the ganglia. These nerves branch to the muscles of the foot, but the main trunks of the posterior pair run back along the floor of the body-cavity for a long distance.

Pleural and Visceral Ganglia and Nerves.—A chain of three ganglia, slightly smaller and rounder than the pedal ganglia, stretches across them towards their anterior ends, above the aorta but below the oesophagus. These three ganglia comprise the right and left pleuro-parietal ganglia and the median abdominal ganglion. The former

are joined to the corresponding pedal ganglia by quite short pleuro-pedal connectives and to the cerebral ganglia by almost equally short cerebro-pleural connectives. There are no pleuro-parietal connectives, because the parietal ganglia are completely merged into the pleural ganglia on each side. The connectives which join the abdominal ganglion with the pleuro-parietal ganglia on each side are of unequal length, the right one being twice as long as the left, which is very short. This is owing to the fact that, while the abdominal ganglion is almost in the middle line, the right pleuro-parietal ganglion is displaced outwards in both species, and therefore lies further from the centre than the left one does, as may be seen from Plate XXVII, fig. 10.

Three rather large pallial nerves arise from the outer and posterior parts of the pleuro-parietal ganglia, but two of them are often united at their origin, as shown in the drawing. The anterior pair bend forwards on reaching the body-wall, to innervate the front part of the mantle; the other two pairs both pass backwards to the lateral portions of the mantle, but the second pair is shorter than the third and its branches innervate a region in front of that innervated by the posterior pair.

The abdominal ganglion gives off two large nerves. The left one arises from about the centre of the posterior surface of the ganglion, trends a little to the right at first, and then passes straight backwards on the floor of the body-cavity to the hinder end of the animal. It passes beneath the receptaculum seminis, to which it gives a short branch, and eventually enters the body-wall and branches around the rectum. Its main division, however, curves to the left just in front of the rectum and ureter, and innervates the left side of the hinder wall of the mantle-cavity. The other nerve from the abdominal ganglion arises towards the right side of its posterior surface, and, trending further towards the right, it runs back close to the aorta. A little in front of the point where the aorta gives off the posterior genital artery, the nerve divides into two branches, of which the smaller follows the aorta, and the larger passes backwards with the genital artery to the organs in the posterior part of the body, although it apparently gives off a branch to the body-wall in the neighbourhood of the pericardium.

The cells in the pleuro-parietal and abdominal ganglia vary in size, as in the other ganglia, some being unusually large. In a specimen of *Onchidella pulchella* the nucleus of one cell at the hinder end of the right pleuro-parietal ganglion measures no less than 0.05 mm. in its greatest diameter.

SENSE ORGANS.

Tentacles, Eyes, and Labial Palps.—The single pair of tentacles can be completely retracted into the head, as shown in Plate XXIXA, fig. 36. Their retraction is effected by means of a pair of rather short, stout muscles, which arise separately from the body-wall on each side nearly as far back as the cerebral ganglia, and are inserted in the extremities of the tentacles. These tentacular retractors are much simpler in structure than they are in most of the Stylommatophora, their anterior portions not being broken up into a number of bundles of fibres with the nerves in the centre, as in ordinary snails and slugs. The tentacular nerves are separate from the retractor muscles until they reach the ends of the tentacles, where each nerve divides into short branches, one of which is the optic nerve innervating the eye. This organ is situated at the tip of the tentacle, and is of the usual type found in the Pulmonata, as will be seen from Plate XXXB, fig. 54. It measures 0.1 mm. in diameter in *O. pulchella*, and has a darkly pigmented retina 0.015 mm. thick, and a central lens. The other branches of the tentacular nerves innervate simple sense-organs which are distributed in the terminal parts of the tentacles, and are probably tactile, and very possibly also olfactory, in function. Numerous short branches of the large labial nerves innervate similar sense-organs in the labial palps, which are evidently very sensitive structures. The form of these palps has already been described.*

Otocysts.—The two otocysts are situated on the upper surfaces of the pedal ganglia at their anterior ends. They are thin-walled vesicles, about 0.04 mm. in diameter, and contain numerous minute otoconia. They are innervated by a pair of slender and rather short nerves from the cerebral ganglia, which pass round the posterior sides of the pleuro-pedal connectives.

Osphradium.—Hitherto an osphradium does not appear to have been known to occur in this family; indeed, von Wissel states that it does not exist in the species of *Onchidella* which he studied, for he searched the whole body for such an organ and failed to find one.† Nevertheless, an examination of serial sections of a specimen of *O. pulchella* revealed a small organ which it is difficult to regard as anything else but an osphradium that has now completely lost its function.

* See p. 241, Plate XXVII, figs. 3, 6; Plate XXIXA, fig. 38.

† Zoolog. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, p. 624.

This little organ is situated in the right side of the body, slightly behind the middle, between the right posterior pallial nerve and the right lateral sinus, where they pass below the posterior part of the pericardium (Plate XXIXc, fig. 44). It consists of a small narrow pit, slightly exceeding 0.01 mm. in depth, and forked at the bottom, as shown in Plate XXVIII, fig. 29. This pit opens upwards into the front end of a long and very narrow passage or duct, which can be traced backwards close to the lateral sinus, and then on the inner side of the right anterior prolongation of the kidney, about as far as the hinder end of the pericardium, where it has become still narrower, and probably ends blindly, although this could not be ascertained with certainty. The duct is lined by a pavement epithelium of flattened cells; but the epithelium lining the pit and extending over its lips is formed of compact columnar cells with deeply-staining nuclei. It will be seen from the figures that the organ is situated very near the large posterior pallial nerve, and it appears to be innervated by a small nerve which runs close beside and parallel to the larger nerve, from which it probably branches a short distance further forward.

The structure of this little organ, and its relations with the right pallial nerve, render it highly probable that it is a vestigial osphradium, such as occurs in the embryo in the Stylommatophora, and in the adult state in many Basommatophora, the pit being similarly forked in *Limnaea*.* The anomalous position of the organ, so far in front of the lung, is explicable when it is remembered that in the ancestors of these slugs the mantle-cavity and its opening were probably situated still further forward on the right side of the animal; and that they then moved back, with the anus, past the position occupied by this organ, when the detorsion took place which is recapitulated in the development of *Onchidella celtica* (Cuv.), according to the observations of Joyeux-Laffaie.† But as the osphradium would almost certainly lose its function when the mantle-cavity was converted into a lung for the respiration of air instead of water, it might well lag behind the other organs and remain nearer to its original position on the right side of the animal, thus obviating the unnecessary lengthening of its nerve. According to this view, the narrow duct, into the end of which the organ opens, represents a portion of the mantle-cavity which became greatly attenuated and drawn out when the larger part of the cavity moved further back.

* Pelseneer, Mém. de l'Acad. Roy. de Belg., vol. liv, 1901, *op. cit.*, p. 40.

† Arch. de Zoologie Expér. et Génér., vol. x, 1882, pls. xx-xxii.

DIGESTIVE SYSTEM.

Buccal Mass.—The mouth is situated on the ventral surface of the head, just behind the inner ends of the labial palps, and is bounded by a transverse lip in front, and by a pair of lateral lips (Plate XXIXA, fig. 38). When the mouth is closed the lateral lips come together, so that it then has the form of a longitudinal slit (Plate XXVII, figs. 3, 6).

The mouth leads upwards and forwards into the anterior part of the buccal mass, which is a relatively large muscular structure, a little narrower in front than towards its hinder end, where it terminates in a pair of lateral swellings. The height of the buccal mass is about 1 mm. in both of the Cape species, and its greatest breadth 1.2 mm. ; while its length, measured from its front wall to the ends of the lateral swellings, is 1.5 mm. in *Onchidella pulchella* and 1.7 mm. in *O. capensis*. Between the lateral swellings at the hinder end of the buccal mass the terminal portion of the radula-sac projects freely for nearly 0.5 mm. in both species (Plate XXVIII, fig. 12).

The principal cavity of the buccal mass extends up the centre of its anterior part, from the passage leading from the mouth below, to the anterior end of the oesophagus above (Plate XXIXA, fig. 36). The front and side walls of this cavity are lined by a well-defined epithelium, which is folded to some extent, the folds running in a vertical direction. This epithelium is 0.025 mm. thick, and consists of long and narrow columnar cells, secreting a rather thick cuticle, and having elongated basal nuclei (Plate XXVIII, fig. 17). Near the opening of the oesophagus, however, the cuticle disappears, and the cells become ciliated (fig. 18). Outside the epithelium the walls of the anterior part of the buccal mass are composed of a great thickness of muscle-fibres, most of which run in a horizontal and circular direction, although some of the inner fibres run vertically. Immediately behind the opening of the oesophagus a short broad papilla or knob projects from the roof of the buccal mass into its cavity ; it is shown in section in Plate XXIXA, fig. 36, a photomicrograph which also makes evident the thickness of the walls of the buccal mass. This knob is covered with an ordinary columnar epithelium, and does not appear to secrete a median plate, such as was found by Plate in the larger species of *Onchidium*.*

The largest organ in the posterior half of the buccal mass is the odontophoral support, in the concave upper surface of which lies the greater part of the radula-sac. The posterior wall of the principal cavity of the buccal mass is formed throughout its central part by the

* Zoolog. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 107, pl. vii, figs. 11, 16.

front end of the odontophoral support, with the anterior half of the radula folded over it. Beneath the front portion of the support the cavity extends back as a broad flattened pocket, which contains the front end of the radula. The epithelium forming the floor of this pocket is composed of columnar cells; that forming its roof of smaller cubical cells.

Above the support the cavity of the buccal mass extends back into the radula-sac, where, however, it soon becomes restricted to a narrow slit containing the radula, owing to the fact that, except near its front end, all the central part of the radula-sac is filled by a long cushion or thick fold depending from its roof (Plate XXXI, figs. 56, 57). The posterior half of the radula occupies the narrow space around this fold; and, as the upper edges of the radula, and of the space in which it lies, are curled inwards, the attachment of the fold to the roof of the radula-sac is very narrow, as may be seen from the figures. In front the fold ends in a short papilla, shown in section in fig. 55; and above this papilla the cavity of the buccal mass extends backwards into a small pocket or pit, of which the transverse section has the form of a horse-shoe, the convexity of which is upwards (Plate XXIXA, fig. 38). The papilla is covered with a regular columnar epithelium, but further back the fold has a much less regular epithelium, which frequently looks as if it were composed of two layers of cells when seen in transverse section. This appearance is probably due to the epithelium being thrown into a large number of very narrow transverse folds which project between the rows of teeth on the radula. The interior of the fold is occupied by a characteristic fibrous connective tissue, which is best shown in fig. 57. The sides and floor of the radula-sac are lined by a cubical epithelium of rather small cells.

The odontophoral support is somewhat boat-shaped in form, except at its hinder end, and has a deep longitudinal groove running along the middle of its concave upper surface (Plate XXXI, figs. 55-57). At the posterior end the right and left halves of the support separate, and occupy the pair of lateral swellings at the hinder end of the buccal mass (Plate XXIXB, fig. 39). Further forwards the two halves are united by a layer of transverse fibres, joining their lower edges; but it is only near the front end of the support that there is complete continuity of structure between the right and left halves beneath the median groove, as shown in fig. 55.

Apart from a thin outer layer of slender fibres, the odontophoral support is composed of two kinds of cells: very long slender cells, which stretch radially from the inner to the outer surface of the

support, and have very narrow elongated nuclei ; and, between these, numerous polygonal cells, with irregularly rounded or discoidal nuclei, which are situated close to the cell-walls, the greater part of the interior of the cells being devoid of protoplasm. At the front end of the support the long radial cells are much more numerous than the polygonal cells, but this is not the case elsewhere. Thus the microscopical structure of the odontophoral support in the Cape species of *Onchidella* is similar to that which Plate found in other members of the family.* But it should be added that the long radial cells are not of approximately the same breadth throughout, as shown in Plate's figure, but become broadened out at their extremities, where they join the outer membrane of the support, and the spaces between them, which are occupied by the polygonal cells, therefore tend to be pointed instead of square at each end. Moreover, under a high power of the microscope, these elongated cells are seen to be longitudinally striated. It would seem very doubtful whether these cells should be regarded as true muscle-fibres, although Plate appears to consider that they are of this nature. It may be mentioned here that, when seen under a high magnification, the muscle-fibres which make up the ordinary muscles of the buccal mass have a dotted appearance, whether they be viewed in transverse or longitudinal section.

Along the outer sides of the odontophoral support there arises a series of powerful muscles on each side, which curve over the edges of the support, passing obliquely forwards and inwards to become inserted in the radula-sac, a large part of which they almost ensheath (figs. 56 and 57 on Plate XXXI show their inner ends). These muscles may be termed the radular retractors. Their external strands seem also to be united with the outer wall of the posterior half of the buccal mass. But the support is also attached to the outer wall by another series of muscles, arising on each side just below the radular retractors, and passing outwards and downwards to the outer wall of the buccal mass. A few of the more posterior strands of the radular retractors appear to be directly continuous with these muscles, and have no attachment to the support. The radular protractors consist of a series of muscles which arise from the ventral wall of the buccal mass towards its hinder end, and are inserted in the pocket which contains the front end of the radula folded back beneath the anterior part of the support. In addition to these three series of odontophoral muscles, there is a single pair of small transverse muscles, which attaches the lower part of the radula-sac to the inside of the support

* *Op. cit.*, pp. 108, 109, pl. vii, fig. 11c.

(Plate XXXI, fig. 57) ; and a slender dorsal muscle, which arises from the roof of the radula-sac not far from its hinder end, and, passing forwards above and partly between the radular retractors, is inserted in the dorsal wall of the buccal mass a little behind the opening of the oesophagus.

Buccal Retractors and Protractors.—The extrinsic muscles of the buccal mass appear to be rather less diversified than those which Plate* and Stantschinsky† found in the larger members of the family. There is first a single pair of large muscles, which unites the anterior wall of the buccal mass to the front of the head (Plate XXVIII, fig. 12).‡ Below these a smaller pair of muscles—the anterior protractors—passes downwards from the front of the buccal mass to the skin that forms the ventral surface of the head in front of the mouth and labial palps and between the bases of the tentacles (Plate XXVIII, fig. 12 ; Plate XXIXA, fig. 36). At the bottom of the anterior wall of the buccal mass, between the points of insertion of the two anterior protractors, there projects in the middle a short, flattened, longitudinal ridge or cushion, which may possibly serve to increase the rigidity of that part of the buccal wall ; and it is very interesting to observe that this cushion is largely formed of radially disposed elongated cells, which are narrow throughout the greater part of their length but become broadened out close to the outer surface. Perhaps the structure of this cushion may be regarded as representing a very rudimentary form of the peculiar tissue of which the odontophoral support is composed, and to which it bears a slight resemblance. Both of the Cape species of *Onchidella* exhibit this structure.

The only other definitely extrinsic buccal muscles which can be clearly made out in these species, in addition to the muscles mentioned above, are the series of powerful muscular strands which are inserted around the lower surface of the buccal mass towards its posterior end, and pass downwards and obliquely forwards to the skin behind and at the sides of the mouth (Plate XXVIII, fig. 12 ; Plates XXIXA and B, figs. 38, 39). These are the muscles which Plate terms the posterior and ventral protractors, and it is possible that, if they contract at the same time as the anterior protractors, they may serve to pull down the

* *Op. cit.*, pp. 104, 105, pl. vii, figs. 12, 15.

† *Zoolog. Jahrb. (Syst., Geogr. u. Biol.)*, vol. xxv, 1907, pp. 357, 358, 376, 381, 384, pl. xiii, figs. 23–25.

‡ These are the muscles which Plate calls the dorsal retractors, but perhaps “anterior retractors” would be a more appropriate name for them, as they are developed in the present species.

whole buccal mass nearer to the mouth-opening, for the protrusion of the radula. But it is also possible that these muscles contract when the anterior protractors are relaxed, and that they serve to pull down only the hinder part of the buccal mass, rotating it about a transverse axis, so that its front part is raised, and the portion of the radula in use is drawn up into the mouth. If this be the case, these muscles are retractors, and not protractors. In favour of this second view it may be stated, in the first place, that these muscles form the largest series of extrinsic buccal muscles, and in most snails and slugs the buccal retractors are much larger than the protractors, doubtless owing to the fact that much less power is required to protrude the radula than to withdraw it again after the cusps of the teeth have become fixed in the food. Secondly, these muscles are inserted in the same place as the well-known buccal retractors of ordinary snails and slugs, muscles which are otherwise unrepresented in these animals. Thirdly, the arrangement of the radular retractors (already described) within the buccal mass, suggests that when they contract the hinder end of the odontophoral support will tend to be pulled upwards and forwards, instead of the radula and the food upon it being drawn into the mouth, unless the hinder end of the buccal mass and of the odontophoral support is simultaneously pulled downwards by the contraction of the muscles that we have been considering.

Jaw.—Both of the Cape species of *Onchidella* possess a jaw ; but it is small, thin, and inconspicuous, and can easily be overlooked when the buccal mass is dissected in the usual way ; it is therefore not surprising that some authors state that they have not been able to find a jaw in the specimens of this genus which they have examined, notwithstanding that Binney found one in *O. borealis* Dall many years ago.*

When the mouth-parts are retracted the jaw is situated some distance within the anterior transverse lip, at the bottom of the front part of the buccal mass, immediately below the level of the median flattened ridge on the buccal mass between the insertion of the anterior protractors. Owing to the fact that the passage from the mouth into the buccal mass goes obliquely forwards, instead of backwards, as in most Pulmonates, the central part of the jaw is lower down than the ends which curve towards the sides of the cavity. Therefore, in a transverse section through the head of a specimen in which the mouth-parts are retracted, the jaw has the appearance of being upside down, the cutting edge being upwards, as will be seen

* Proc. Acad. Nat. Sci. Phila., 1876, p. 184, pl. vi, fig. BB.

from the photomicrograph (Plate XXXI, fig. 59). This figure does not show quite the whole of the jaw, the extremities of the curved ends appearing in the succeeding section. It illustrates the fact, however, that the central part of the jaw is not quite straight, but curves slightly outwards towards the cavity.

The jaw consists of a number of thin, very irregular, oblong plates, more or less intimately fused with one another. These plates, of which there may be as many as thirty, show a very fine and indistinct striation parallel to their greatest length, which is at right angles to the length of the jaw. On the whole, it may be said that the jaws of both of the Cape species are of the same general type as that of *O. coquimbensis* Plate, as described and figured by von Wissel.* In *O. pulchella* the jaw measures only 0.25 mm. in length, by about 0.035 mm. in breadth; in *O. capensis* it appears to be slightly larger.

Radula.—The position of the radula in the buccal mass has already been described, but we have still to deal with the organ itself as it appears when freed from its surrounding tissues. It measures, when flattened out, about 1.8 mm. in length, by 0.85 mm. in breadth, in *Onchidella pulchella*. In specimens of *O. capensis* from Sea Point, near Cape Town, it varies from 2.7×1.1 mm. to 2.2×0.9 mm.; but in a large example of the same species from Green Point it measures 3.2×1.2 mm. In specimens of *O. capensis* var. *paucidentata* from Buffels Bay it varies from 2.4×1 mm. to 2.1×0.8 mm.

The radula usually has about 70 or 80 transverse rows of teeth, and more than twice that number of teeth in each row, as will be seen from the following table, which gives the radular formulae of the specimens examined:—

<i>O. pulchella</i> , St. James, False Bay	. (91+1+ 90)×69
" " "	. (84+1+ 86)×74
" " "	. (83+1+ 82)×62
<i>O. capensis</i> , Green Point, Cape Town	. (116+1+117)×83
" Sea Point, "	. (113+1+114)×86
" " "	. (114+1+110)×75
" " "	. (97+1+ 95)×77
" var. ; Buffels Bay	. (79+1+ 78)×70
" " "	. (77+1+ 76)×76
" " "	. (77+1+ 77)×71

* Zoolog. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, p. 601, pl. xxxiv, fig. 11a.

It will be noticed from this table that there are frequently slightly more teeth on one side of the radula than on the other; and, further, that among the specimens examined those in which the larger number of teeth occurs on the left side are twice as numerous as those in which it occurs on the right. The number of specimens, however, is much too small to judge whether this denotes a slight tendency towards an asymmetry in the radula of the same nature as we find in so many of the other organs in the Gastropoda. The anterior end of the radula is pointed, and the first six or eight rows are consequently incomplete, the most anterior row consisting of only a very few worn teeth, which may belong exclusively to one side when the radula is not quite symmetrical.

The rows of teeth form a conspicuous angle in the centre, of about 100° to 120° , as shown in the photomicrograph (Plate XXXI, fig. 58). The angle points forwards, and on each side the rows of teeth slope fairly evenly backwards until they come very near to the edges of the radula, where they curve outwards.

The individual teeth are very small, but it is unnecessary to give their exact measurements here, as their sizes can be seen, not only from the photomicrograph, but also from Plate XXVIII, figs. 13–16, in which all the teeth figured are drawn to scale. The central tooth in each row is broader and shorter than the others, especially in *O. pulchella*, and is tricuspid, all the cusps being small and less than half the length of the basal plate, although the mesocone is about twice the size of the ectocones.

The remaining teeth are bicuspid, and are on the whole very similar to one another both in shape and size, except that the first tooth on each side is shorter than the others, and at the extreme edges of the radula the teeth become slightly smaller, with shorter cusps, the last two or three being reduced to thin, oblong plates. The teeth, therefore, are not differentiated into an admedian and a marginal series. All these teeth, apart from the degenerate ones at the edges of the radula, have large mesocones, with very long cusps, broadly truncated at their extremities, except in the first tooth and in those towards the outer edges of the radula, where they are more conical. The inner angles at the extremities of these cusps are rounded, but the outer angles are somewhat pointed, more so than in most species of *Onchidella*. It will also be seen from the figures that each of these cusps consists of a thickened outer portion, broadening slightly towards the extremity; and, on the inner side of this, a thin triangular portion, broad near the base but tapering towards the extremity of the cusp.

These inner flanges of the mesocones, which have been generally overlooked by previous writers on this genus, may be said to take the place of endocones, which do not occur in *Onchidella*.* When viewed from the side, the points of the mesocones are seen to be somewhat curved downwards, or, in other words, slightly hooked (Plate XXVIII, fig. 16). In contrast to the mesocones, the ectocones are always quite small, with very short, conical cusps.

The bases of all the teeth, except the centrals, are narrow, with the thickened part from which the cusps arise disposed obliquely, so that the outer end of the base of one tooth lies behind the inner end of the base of the succeeding tooth. Oblong basal plates extend back beneath the cusps. Those of the first teeth on each side are quite as long as their mesocones; but as the teeth are followed outwards they gradually get shorter, until near the edges of the radula they scarcely extend beyond the small ectocones.

A long narrow process extends forwards from the inner side of the anterior border of each lateral tooth, except the first six and the last two or three on each side (Plate XXVIII, figs. 14-16). These processes form an angle with the bases of the teeth, trending slightly outwards and downwards as well as forwards. Their anterior ends underlie the cusps of the row of teeth in front of the row to which they belong. When viewed from the side they appear straight and sharply pointed at the end, but when viewed from above they are seen to curve slightly outwards in the middle and to end more bluntly.

These peculiar processes occur also in the other species of *Onchidella*; but in some of these, such as *O. borealis* Dall, they are broader, especially towards their posterior ends, than they are in the species from the Cape and from New Zealand; and, judging from the radulae of allied genera, this broader form is probably the more primitive, the narrow process representing the thickened inner edge of an originally broader anterior prolongation of the tooth. Possibly the function of these processes may be to act as kind of props, preventing the teeth from being turned over forwards, when the radula is being drawn back into the mouth after the cusps of the teeth have become fixed in the food.

Salivary Glands.—The paired salivary glands lie one on each side of the buccal mass (Plate XXVII, fig. 7; Plate XXVIII, fig. 12; Plates XXIXA and B, figs. 36-39). Sloping slightly downwards, they extend

* Von Wissel evidently mistook for endocones the basal attachments of the mesocones, and Binney seems to have fallen into a somewhat similar error (see p. 238).

as far back as the nerve-ring, but they do not pass through it. Each gland is of an elongated form, measuring nearly 1.5 mm. in length, and consists of a number of separate oval lobules or acini, springing from a central duct, as is best shown in fig. 12. Only the anterior 0.3 mm. of the duct is free from lobules. The ducts disappear into the dorsal surface of the buccal mass on each side of the anterior end of the oesophagus; but sections show that, instead of going straight through the thick wall of the buccal mass, the ducts pass obliquely downwards, and open into the buccal cavity on each side fully 0.3 mm. below the place where the oesophagus opens through its roof.

The lobules of the salivary glands consist chiefly of a mass of rather large secretory cells, traversed by small branches of the main duct. Throughout the greater part of its length, however, the main duct itself has outside its epithelium a rather thick layer of secretory cells, though these cells are perhaps slightly smaller than those of which the lobules of the gland are composed. Near the anterior end of the duct this glandular layer disappears; but as the lumen of the duct becomes at the same time much broader, its external diameter is not diminished. As the duct passes through the muscular wall of the buccal mass, its lumen again becomes narrower.

Oesophagus and Crop.—As already mentioned, the oesophagus arises from the dorsal surface of the buccal mass, close to its front end; in fact the opening of the oesophagus lies further forward than the mouth when the mouth-parts are retracted—a very unusual condition to find in the Pulmonata. The oesophagus first passes backwards above the buccal mass, and then curves downwards nearly to the floor of the body-cavity, in order to pass through the nerve-ring (Plate XXVIII, fig. 12; Plates XXIXA and B, figs. 36–39). It usually passes down on the left side of the hinder part of the buccal mass, possibly because the radula-sac projects in the middle, and the presence of the penis on the right side leaves less room on that side than on the left. Excepting where it passes through the small nerve-ring, the oesophagus is rather broad.

The walls of the oesophagus are of no great thickness, but internally they are thrown into a number of prominent longitudinal, or nearly longitudinal, folds; and these are crossed, in both the Cape species, by numerous small transverse folds, which give to the walls of the oesophagus a very characteristic appearance, whether viewed from within (Plate XXVII, fig. 8), or in longitudinal section (Plate XXVIII, fig. 19). The epithelium lining the oesophagus is formed of columnar

cells, which are ciliated near the opening into the buccal mass. Outside this epithelium there is a rather thin layer of muscular fibres.

Behind the nerve-ring the oesophagus becomes greatly swollen, to form a very large crop, which extends back as far as the stomach, and attains a breadth of at least 1.5 mm. in the middle, filling the larger part of the body-cavity behind the buccal mass and in front of the region of the heart (Plate XXVIII, fig. 12; Plates XXIXB and C, figs. 40-44). The crop in the Cape species of *Onchidella* is thus very much larger than it is in *O. celtica* (Cuv.), according to Joyeux-Laffuie's figures,* though probably not larger than in some other species, such as *O. accrensis* Plate.†

The walls of the crop are thin, with some low internal folds, which run in a longitudinal direction. They are lined by an epithelium of cubical cells, which are ciliated in places, especially along the folds, and have rounded nuclei (Plate XXVIII, fig. 20). Outside the epithelium there is a thin layer of muscle-fibres running in a circular direction; but the entire thickness of the crop wall does not exceed 0.01 mm. in many places.

Stomach and Intestine.—The stomach is unusually complex, and may be regarded as being formed of no fewer than five divisions. The first division is comparatively small, and lies above the hinder end of the crop, from which it is not very clearly divided (Plate XXVIII, fig. 12; Plate XXIXC, fig. 44). It forms a short, broad passage leading obliquely upwards and backwards from the crop into the main divisions of the stomach; but, inasmuch as the anterior division of the liver opens into it, it is probably correct to regard it as a part of the stomach itself.

The principal part of the stomach is formed of three divisions lying one behind another, and may be seen near the upper surface of the visceral mass, a little behind the centre, when the body-cavity is opened from above (Plate XXVII, fig. 7). Of these three divisions the middle one forms a muscular gizzard, having on each side a great development of muscular tissue external to its epithelium (Plate XXVIII, figs. 12, 23). The muscular tissue attains a thickness of 0.25 mm. in the middle of each side, with the result that when seen from the outside this division of the stomach appears to be considerably broader than high. The muscle-fibres have a dotted appearance when highly magnified, as in the case of those in the buccal mass. They

* Arch. de Zoologie Expér. et Génér., vol. x, 1882, pl. xiv, fig. 4; pl. xv, fig. 1.

† Plate, Zoolog. Jahrb. (Anat. u. Ontog.), vol. viii, 1893, p. 112.

run chiefly in a circular direction, but alternating with the layers of circular fibres are thinner concentric layers of horizontal fibres, which run at right angles to the circular fibres but are also parallel to the outer surface of each muscular mass. Dorsally and ventrally these rounded masses of muscular tissue are united by much thinner bands of transverse muscle-fibres. Inside the muscular tissue there is a well-defined epithelium of fairly small columnar cells, with basal nuclei, and these cells secrete a remarkably thick cuticle, as will be seen from fig. 23. In both of the Cape species of *Onchidella* this cuticle attains in places a thickness of 0.025 mm.; but it does not show the radial structure that Plate found in the cuticular lining of the gizzard in *Onchidium*.^{*} This division of the stomach doubtless forms an efficient organ for the complete crushing of the particles of food, being aided in its action by the grains of sand which the stomach contains.

Immediately behind and in front of this muscular division of the stomach lie two other divisions, with thinner, internally folded walls (Plate XXVIII, fig. 12). The posterior one is semi-ovate, or almost hemispherical, and forms the hinder end of the stomach. Its epithelium is longitudinally folded, and consists of columnar cells bearing short inconspicuous cilia. This division of the stomach receives the hepatic duct from the posterior division of the liver. Apparently this part of the stomach is better developed in the Cape species of *Onchidella* than in most members of the family, for in the anatomical descriptions which have hitherto been published it is not clearly described, and the posterior division of the liver is usually said to open into the muscular part of the stomach, which is certainly not the case in either of the present species.

The division of the stomach immediately in front of the muscular part, or gizzard, is larger than that just described, being broad near its hinder end but becoming narrower anteriorly. The first division of the stomach, leading from the crop, opens upwards directly into the hinder part of this division (Plate XXVIII, fig. 12). Its walls have an external rather thin layer of muscle-fibres, most of which seem to run in a circular direction; while internally they form a number of large longitudinal folds, covered by an epithelium composed of rather irregular columnar cells, which are strongly ciliated (Plate XXVIII, fig. 22). One specially large fold, with a slight groove along the top, runs along the left side of the floor of this part of the stomach, apparently passing up into it from the first division, where it seems to originate near the openings of the anterior division of the liver,

^{*} *Op. cit.*, p. 115, pl. viii, fig. 28.

and continuing into the next part of the stomach, where it may be seen in section in Plate XXIXc, fig. 44. A similar fold has been found in other species, and probably serves to direct a part of the secretion of the liver towards the intestine.

The part of the stomach just described leads forwards and downwards into the final division of the stomach, which gives off from its posterior end a small conical caecum, directed backwards below the preceding division (Plate XXVIII, fig. 12). The caecum is lined by a ciliated columnar epithelium. This last division of the stomach is quite small, and leads directly forwards into the intestine, of which it might almost be regarded as the slightly swollen initial portion. Its epithelium seems to be intermediate in character between that of the last part of the stomach and that of the intestine, and is thrown into rather low longitudinal folds, in addition to the larger fold mentioned above (Plate XXIXc, fig. 44).

The course of the intestine—and of the rectum, which is scarcely separable from it—may be seen from Plate XXVII, fig. 7; Plate XXVIII, fig. 12; Plates XXIXb and c, figs. 40–44; and Plates XXXa and b, figs. 46–50. The intestine passes forwards from the stomach, and then bends down on the right side of the anterior part of the crop, coming close to the right body-wall, and forms a loop through which the aorta passes. It bends up again, and then passes backwards on the right side of the stomach and above the genital organs, until it finally curves down, at the extreme end of the body-cavity, towards the anus, which, it will be remembered, is situated in the hyponotum in the middle line just behind the posterior extremity of the foot. The part of the intestine behind the stomach and liver might perhaps be regarded as the rectum, but the last 0.5 mm., where it passes vertically down through the hyponotum, would be more correctly termed the cloaca, inasmuch as the ureter opens into the left side of the rectum a short distance above the anus.

The walls of the intestine are thin. Externally there is a thin layer of muscle-fibres, mostly running in a circular direction. Internally there is an epithelium composed of short, rather irregular, columnar cells, which are often somewhat swollen with vacuoles, and bear rather short cilia (Plate XXVIII, fig. 21). In the rectum, however, the cilia seem to be slightly longer, although in other respects the structure of the rectum is very similar to that of the intestine in front of it. The walls of the intestine and rectum are folded internally, especially on the upper or outer side, the epithelium on the inner side being flatter and thinner. The folds are not exactly longitudinal,

but slope slightly downwards on each side, especially in the first half of the intestine, as shown in fig. 12. The diameter of the intestine and rectum measures between 0.2 and 0.25 mm.

Liver.—The digestive gland or liver consists of two main divisions : a very large anterior division, which is subdivided into a right and a left portion, and a very small posterior division (Plate XXVII, fig. 7 ; the anterior division is shown in section in Plates XXIX_B and C, figs. 39–44, and Plate XXX_B, figs. 49, 50 ; the posterior division in Plates XXX_A and B, figs. 48, 49). The left anterior portion is somewhat larger than the right, and extends over the left side of the crop, to the left of the stomach and the intestine in front of it. The right anterior portion covers the right side of the crop, to the right of the stomach and the part of the intestine that leads forwards, but on both sides of the part that passes back again. Both portions are split up into separate lobes, which become subdivided peripherally into a large number of small lobules.

The lobes of the liver are covered by a thin layer of connective tissue, within which can be seen in many sections a lining of very long, irregular, secretory cells, which converge towards the central cavities of the lobules (Plate XXX_B, fig. 51). Some of the largest of these hepatic cells attain a length of 0.05 mm. ; they have oval nuclei. The liver also seems to contain three types of secretions : (1) a large quantity of a finely granular, lightly staining substance ; (2) rounded masses of very small refractory granules tinged with brown, which appear dark in the photomicrograph (fig. 51) ; these granules measure between 0.002 and 0.003 mm. in diameter, and are probably of a calcareous nature ; and (3) scattered globules or concretions of a rather dark brown colour, varying in size, but having an average diameter of about 0.005 mm. These secretions usually give to the liver a light brown colour in specimens preserved in alcohol.

The hepatic ducts from both the anterior portions of the liver open together into the front of the first division of the stomach, as shown in Plate XXVIII, fig. 12, and Plate XXIX_C, fig. 44. The ducts are very broad and greatly branched. They are lined by an epithelium of strongly ciliated cells, which is folded in a longitudinal direction, the folds being high and narrow, and giving a characteristic appearance to the walls of the larger ducts when seen in transverse section (Plate XXVIII, fig. 24).

The posterior division of the liver is similar in structure to the anterior division, but it is extremely small, as in most species of

Onchidella, except *O. celtica* (Cuv.) and *O. pachyderma* Plate. It is situated behind and a little to the left of the posterior division of the stomach. It opens towards the left side of the hinder end of this portion of the stomach by a short and simple duct (Plate XXVIII, fig. 12; Plate XXXB, fig. 49).

REPRODUCTIVE SYSTEM.

Hermaphrodite Gland and Duct, and Vesicula Seminalis.—With the exception of the penis and the greater part of the vas deferens, the genital organs, when fully developed, form a compact mass which almost entirely fills the posterior third of the body-cavity (Plate XXVII, fig. 7). The lower part of the left side of this region is occupied by the hermaphrodite gland or ovotestis (Plate XXVII, fig. 11; Plates XXXA and B, figs. 46–50). This organ consists of a bunch of six or seven rather large follicles, ovately conical in form, their broader ends being directed outwards. The walls of the follicles are very thin, and each of them contains both ova and spermatozoa, the ova being chiefly situated towards the outer ends of the follicles and giving a slightly dotted appearance to the outside of the hermaphrodite gland when seen through a lens.

The unfertilised ova in the gland attain a diameter of 0.1 mm. in both of the Cape species of *Onchidella*. The spermatozoa, which occur in numerous clusters, have exceptionally small heads when they are fully developed; but their tails are very long, being probably about 0.2 mm. in length.

The slender ducts leading from the inner ends of the follicles quickly unite with one another to form the common hermaphrodite duct. At first this duct is very narrow, but it soon becomes somewhat swollen and greatly convoluted, forming a mass of broad loops, as shown in Plate XXVII, fig. 11. The hermaphrodite duct then becomes very narrow again, and somewhat straighter, passing obliquely forwards; but eventually it bends inwards, thickening a second time as it does so, and on this thickened part it bears a small narrow diverticulum, which is the vesicula seminalis. Beyond this the hermaphrodite duct becomes slightly narrower again for a short distance, until it passes into the spermoviduct. The rather thin walls of the hermaphrodite duct are lined by an epithelium of cubical cells bearing remarkably long cilia.

Spermoviduct and Adjacent Glands.—The common duct, or spermoviduct, is broader and very much shorter than the hermaphrodite

duct, of which it is the continuation. One side of the spermooviduct, that which is usually turned towards the left, has a thin wall lined by an epithelium of cubical or somewhat flattened, strongly ciliated cells. The other side has a thick glandular wall, which is expanded so as to form a kind of hollow longitudinal fold projecting towards the right. Here the epithelial cells become converted into narrow supporting cells, which, however, are broadened at their inner ends next to the cavity, where they are still strongly ciliated. Outside of these cells, and extending between them, there is a thick compact layer of large polygonal gland-cells, with homogeneous finely granular contents, apart from their rounded nuclei. Fig. 25 on Plate XXVIII shows the transition from the thin to the glandular side of the spermooviduct wall. It is from the thin-walled side that the vas deferens takes its origin at the lower end of this duct.

The spermooviduct lies almost in the centre of the complex mass of genital organs in the hinder part of the body, and is hidden by various large glandular outgrowths which lie on the top of it (Plate XXXB, fig. 50). These accessory glands are closely pressed upon one another and upon the adjacent organs, and they are also very delicate and brittle; it is therefore almost impossible to separate them without breaking them to pieces. Doubtless for this reason nearly every author who has attempted to describe the genital system of *Onchidella* has given an entirely different account of these organs. The present writer's observations on the Cape species suggest that von Wissel's description will prove to be the most nearly accurate of those which have hitherto been published.*

The albumen glands are very large, especially in *O. pulchella*, and are situated above most of the other genital organs, though they extend forwards beneath part of the stomach and liver (Plate XXVII, fig. 11; Plates XXXA and B, figs. 46-50). They open into the upper end of the spermooviduct, where the hermaphrodite gland passes into it, by means of ducts which are lined by an epithelium of strongly ciliated columnar cells. The albumen glands consist of a number of irregularly rounded or oval lobes, but they were so extremely brittle in the material available that it was impossible to make out with certainty the exact arrangement of these lobes; probably, however, they are arranged in two groups to form a pair of glands as described in other members of the family. The secretory cells of the albumen glands are very full of small globules of secretion; indeed so full were they in the specimens examined that the precise form of the individual

* Zoolog. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, pp. 624-633.

cells could not be seen. Owing to this secretion the glands are of an opaque light-brownish colour.

Lying close against the albumen glands, and also opening into the upper part of the spermooviduct, there is another pair of glands, not so large as the albumen glands, and distinguishable by their convoluted form and translucent gelatinous appearance (Plate XXVII, fig. 11; Plates XXXA and B, figs. 48-50). Each of these two glands consists essentially of a closely convoluted tube, with thick glandular walls and a rather narrow sinuous lumen lined by long cilia. The complicated appearance of these glands, when seen in section, is shown in fig. 61 on Plate XXXI. Apart from the investing connective tissue, these glands are mainly formed of abundant secretory cells and ciliated supporting cells. The secretory cells are usually somewhat oval in form, but vary greatly in size; their nuclei are relatively rather small, and the greater part of their contents is only very faintly granular, so that these cells appear clearer than the secretory cells of the other genital glands. Where the secretory cells are well developed the supporting cells are very narrow, only becoming broadened at their inner ciliated ends, and, to a less extent, at their centres where their nuclei are situated. But in those parts of the glands where the secretory cells are but little developed the supporting cells are much shorter and not so narrow, and they thus come to form a layer which in appearance approaches an ordinary ciliated epithelium (see the centre of fig. 61).

These two glands are those which von Wissel named the spermooviduct glands, and he was probably right in suggesting that they may be nidamental in character. They appear to correspond to the so-called spiral ducts in *Onchidium*, and to the translucent and glandular, sacculated part of the spermooviduct in the majority of Pulmonates, the much greater length of the spermooviduct in most snails and slugs giving an area of glandular tissue little, if any, less than that which is afforded by these lateral outgrowths in *Onchidella*.

In addition to the albumen and spermooviduct glands opening into the upper part of the short spermooviduct, and the glandular enlargement of one side of the duct itself, a very large glandular sac opens into the dorsal side of the lower part of the spermooviduct (Plate XXVII, fig. 11). This large hollow gland has an opaque white appearance, and usually extends round the right side of the anterior part of the genital mass, its outer side lying against the right wall of the body-cavity (Plate XXVII, fig. 7); but it is often very irregular in shape, its expansion in various directions probably depending on where there is most room for it to extend. The wall of the gland is formed of a

single layer of very large secretory cells, with slender supporting cells between them, surrounded by an extremely thin layer of flattened connective-tissue cells with discoidal nuclei (Plate XXVIII, fig. 27). The secretory cells are columnar in form, appearing oblong in longitudinal section and polygonal when the wall is cut tangentially, and are all very large, frequently attaining a length of 0.05 mm. They contain a granular secretion, the granules being somewhat coarser in the cells near the opening of the gland than in those situated elsewhere. They have rounded or oval, deeply staining nuclei, which are always situated at the outer or basal ends of the cells, and are of an unusually large size, being often as much as 0.13 mm. in diameter. Between these secretory cells there are very long and narrow supporting cells, with small nuclei, which are usually, but not always, situated in a slight thickening at the cell's inner end. Near the opening of the gland, and to some extent also elsewhere, the supporting cells bear very long cilia.

This glandular sac opens into the lower end of the spermoviduct by a rather large orifice, without the interposition of any duct. The orifice takes the form of a longitudinal slit, of which the upper part opens into the dorsal side of the thin-walled portion of the spermoviduct above the beginning of the vas deferens (Plate XXXB, fig. 50), while the lower part of the slit extends below the internal separation of the male and female ducts, and thus opens into the initial portion of the vas deferens. According to von Wissel, in the South American species of *Onchidella* which he examined, this glandular appendix opens into the upper part of the spermoviduct, between the openings of the spermoviduct glands; * but this is not the case in either of the Cape species. It would seem probable, therefore, that the South African and the South American species differ from each other in this respect, unless von Wissel mistook for the base of the glandular appendix what was really the hollow glandular fold of the spermoviduct wall, a feature which he does not describe.

This large gland, when it has been noticed at all, has usually been referred to merely as an appendix of the spermoviduct; but it seems to be not improbable that it is homologous with the so-called prostate gland of other Pulmonates. In support of this view it may be urged that (1) it resembles the prostate gland in its opaque white appearance, and rather closely also in the microscopical structure of its walls; (2) it opens partly into the male side of the spermoviduct and partly into the vas deferens itself; and (3), while *Onchidella* has a full com-

* *Op. cit.*, p. 628, pl. xxxvi, fig. 26.

plement of female glands, there is no gland apart from this one which could be regarded as in any way homologous with the prostate which is so generally found in the Pulmonata. On the other hand, this organ differs from the normal prostate gland in consisting of a single large sac, instead of being divided into a large number of small tubules.

Oviduct, Receptaculum Seminis, and Vagina and its Gland.—The upper end of the oviduct, where the vas deferens is still closely attached to it and only separated from it internally, is very similar in structure to the spermoviduct, and has a continuation of the hollow glandular fold on its right side (Plate XXXB, fig. 49). A little further down, however, where the vas deferens becomes externally separated from it, the oviduct changes its character completely, and becomes converted into a muscular duct with thick walls longitudinally folded inside (Plate XXXA, figs. 47, 48). The walls are lined by an epithelium of strongly ciliated columnar cells, which is surrounded by a thick muscular layer of mixed circular and longitudinal fibres interspersed with connective-tissue cells (Plate XXVIII, fig. 26). The length of the free part of the oviduct as far as its union with the receptacular duct is about 0.75 mm.

The receptacular duct is slightly longer and nearly twice as broad as the free oviduct, measuring about 0.3 mm. in breadth, except near its distal end where it becomes narrower, its external diameter being reduced to 0.2 mm. (Plate XXVII, fig. 11; Plate XXXA, figs. 46–48). The walls are thick and muscular, and are furnished inside with very prominent longitudinal folds. It is lined by an epithelium of columnar cells, which appear to be without cilia except at the proximal end of the duct. Outside the epithelium there is a thick layer of circular muscle-fibres, with which are mingled some connective-tissue cells and a certain number of longitudinal muscle-fibres, the latter occurring chiefly near the outer surface.

The receptacular duct ends distally in a large spherical receptaculum seminis or spermatheca, which is situated underneath most of the other genital organs (Plate XXVII, fig. 11; Plates XXXA and B, figs. 48–50). The wall of the receptaculum seminis is not nearly so thick as that of the duct, the lining epithelium being surrounded by only a thin layer of connective tissue and muscle-fibres. The epithelium consists of a compact layer of rather large cells, which have a finely granular content and are possibly of a secretory nature. In two specimens of *Onchidella pulchella*, in which sections of the epithelium were

examined microscopically, these cells were very long and narrow, as shown in fig. 28 on Plate XXVIII; whereas in a single specimen of *O. capensis* they proved to be much broader and shorter; but as the receptaculum seminis of the last example measured 1 mm. in diameter, while in the specimens of the other species its diameter was only about 0.5 mm., it is possible that this difference may have been chiefly due to the organ being in a more distended condition in the specimen of *O. capensis* than in the other two individuals.

The spermiduct and the free oviduct pass backwards beneath the albumen glands, etc., and only slope slightly downwards; but the vagina, that is to say, the part of the female duct below the opening of the receptacular duct, descends more nearly vertically to its external opening, just to the right and in front of the anus. The length of the vagina, including the part of it that penetrates the hyponotum, is about equal to that of the free oviduct, although the vagina is nearly twice as broad; and its structure also closely resembles that of the free oviduct, the walls being thick and muscular, with internal longitudinal folds and a ciliated columnar epithelium (Plate XXXA, fig. 46).

About half-way down the part of the vagina that lies within the body-cavity it bends outwards to one side, forming a kind of swelling, as shown in fig. 11 on Plate XXVII. The outer side of this protuberance is formed by a great thickness of muscular tissue composed of unusually stout muscle-fibres, which run in a crescentic direction and have oval nuclei, together with a few vacuolated connective-tissue cells scattered among them. Fig. 47 on Plate XXXA shows a section of this protuberance of the vagina. Possibly it may serve some purpose in the process of copulation; or perhaps its function is to retain the eggs for a time as they pass down the vagina, while they receive some secretion from the vaginal gland. Von Wissel has described a somewhat similar muscular swelling on the vagina of *O. nigricans* (Q. and G.), the type species of *Onchidella* from New Zealand.*

The vaginal gland takes the form of a loosely convoluted glandular tube, which opens into the vagina exactly opposite to the muscular swelling just described (Plate XXVII, fig. 11; Plate XXXA, fig. 47). This tubular gland attains a diameter of about 0.1 mm. in both of the Cape species of *Onchidella*, except near its opening into the vagina, where it is slightly narrower. Sections show that this terminal portion has a ciliated cubical epithelium, which is surrounded by a muscular

* Zoolog. Jahrb. (Syst., Geogr. u. Biol.), vol. xx, 1904, p. 666, pl. xxv. figs. 73, 74.

layer chiefly composed of circular muscle-fibres mixed with some connective-tissue cells; this part thus forms the duct of the gland itself. A short distance above the opening, however, the structure changes rather abruptly, and the remainder of the organ is of a wholly glandular nature, having an epithelium of slightly irregular columnar secretory cells, which is only surrounded by quite a thin layer of connective tissue. The secretory cells are rather large, and have rounded nuclei situated close to their outer ends, while the inner halves of the cells are filled with a very granular secretion (Plate XXVIII, fig. 33). No supporting cells were found, such as occur between the secretory cells in most of the other genital glands.

Vas Deferens and Penis.—The vas deferens is at first closely united with the left side of the upper part of the oviduct, but it soon becomes free and follows an independent slightly sinuous course to the floor of the body-cavity, where it disappears just in front of the vagina. It passes straight through the greater part of the thickness of the body-wall, but before reaching the lower surface it bends almost at right angles, and passes to the right as far as a point only about 0.03 mm. above and to the right of the ciliated groove in the hyponotum that runs forward on the right side of the foot (Plate XXXI, fig. 60). The vas deferens then passes forward in the body-wall close beside this groove, until the latter curves to the left in front of the anterior end of the foot. At this point it leaves the side of the groove, and passes a short distance further forward in the skin of the right side of the head, until it almost reaches the opening of the penis, where it turns inwards and emerges again into the body-cavity. Here it becomes loosely convoluted, but after describing three or four loops below the penis, it passes backwards for nearly half the length of the animal in the right side of the lower part of the body-cavity (Plate XXVII, fig. 11). It then enters the penial retractor, bending round again as it does so, and finally runs forward in the retractor to the penis, into the side of which it enters a short distance in front of its hinder end. The total length of the vas deferens, from its separation from the spermoviduct to its entry into the penis, must be equal to at least twice the entire length of the animal.

Very long cilia surround the opening of the spermoviduct into the vas deferens. The first part of the vas deferens, where it is united with the oviduct, is broader than the rest and oval in transverse section, measuring 0.15×0.08 mm. in diameter, its greatest breadth being parallel to the adjacent wall of the oviduct. Its walls have

internal longitudinal folds (Plate XXXB, fig. 49), and they are lined by an epithelium of short columnar ciliated cells.

Where the vas deferens becomes detached from the oviduct the internal longitudinal folds soon disappear, and the male duct becomes narrower and more nearly circular in section, measuring between 0.06 and 0.07 mm. in diameter throughout the greater part of its length. It is lined by an epithelium of cubical or short columnar cells, which are strongly ciliated. Immediately external to the epithelium there is a zone of vacuolated connective tissue, and outside of this a muscular layer consisting mainly of muscle-fibres running in a circular direction. This structure scarcely changes until the vas deferens enters the penial retractor; but in the part in the anterior half of the body-cavity the zone of vacuolated connective tissue between the epithelium and the muscular layer is usually broader, and the lumen is consequently narrower than in the posterior part of the vas deferens (Plate XXVIII, figs. 30, 31).

On entering the penial retractor muscle to pass forward to the penis, the vas deferens undergoes a change in its structure. The cilia and the zone of vacuolated connective tissue disappear, the lumen becomes narrower, and the nuclei of the cubical epithelial cells stain darker with haematoxylin. A thin layer of circular muscle-fibres immediately surrounds the epithelium, and outside of it there is a thick layer of longitudinal muscle-fibres appertaining to the penial retractor (Plate XXVIII, fig. 35). A few connective-tissue cells are scattered among these longitudinal fibres, and in addition there is a thin, loose, outer sheath of connective tissue, which also extends round the posterior part of the preceding division of the vas deferens as it passes backwards. In this sheath may be found scattered clusters of minute granules, which are probably of a calcareous nature.

The vas deferens lies approximately in the centre of the muscular tissue of the penial retractor until it arrives close to the hinder end of the penis. Here it passes towards the lower left side of the muscle, and at the same time a large number of vacuolated connective-tissue cells become intercalated between the longitudinal fibres of the muscle, which consequently becomes greatly enlarged above and to the right of the vas deferens, so as to form a mass of tissue on the end of the penis nearly as broad as the penis itself, and looking as if it were part of it when the organ is seen from the outside. (A part of this mass of vacuolated tissue at the end of the penis can be seen in section in Plate XXXI, fig. 62.) The vas deferens then passes forwards into the ventral wall of the penis, surrounded by a little of the vacuo-

lated connective tissue. At first it lies near the outer surface of the penis, but it soon curves inwards, becoming very narrow as it does so, and opens by a pore in the apex of a short penis-papilla, which projects obliquely into the cavity of the penis from its ventral wall, a short distance in front of its posterior end (Plates XXIXA and B, figs. 38, 39).

The penis is a simple finger-shaped organ, without accessory glands, and lies on the right side of the buccal mass, sloping slightly upwards towards its hinder end, and opening in front on the side of the head behind the right tentacle. It measures about 1.4 mm. long by 0.3 mm. broad, but it is slightly narrower in the second quarter than in the first, third, and fourth quarters of its length, counting from the posterior end (Plate XXVII, fig. 11). It has thick muscular walls, lined by an epithelium of short columnar cells (Plate XXVIII, fig. 34). Except near the opening to the exterior, the inside of the wall of the penis is excavated into a number of pits, encircled by slightly projecting lips; and in many of these pits concretions are found, which project into the cavity of the penis. These concretions may serve to roughen the outer surface of the penis when it is exerted, and Joyeux-Laffuie has shown that in *Onchidella celtica* (Cuv.) they are composed of uric acid.*

The retractor muscle of the penis arises from the right side of the floor of the body-cavity towards the hinder end of the animal, about opposite to the posterior extremity of the pericardium (Plate XXVII, fig. 11). It runs straight forward to the posterior end of the penis in which it is inserted, its anterior half enclosing a part of the vas deferens, and its front end being much enlarged by the intercalation of vacuolated connective-tissue cells between its fibres, in the manner already described.

DIFFERENCES BETWEEN THE FORMS OF *ONCHIDELLA* FOUND AT THE CAPE.

Onchidella pulchella, n. sp.

(Plate XXVII, figs. 1-3; Plate XXVIII, figs. 15-35;
Plates XXIX-XXXI.)

Size about 5.8 mm. long, 3.6 mm. broad, and 2.5 mm. high in the middle.

Form oval, but rather narrow, especially towards the anterior end. Back rather strongly arched, and bearing a number of scattered papillae, the larger of which are very prominent. Marginal glands

* Arch. de Zoologie Expér. et Génér., vol. x, 1882, p. 329.

usually about 22 in number, their positions being indicated by a series of prominent swellings round the mantle-edge. Hyponotum generally decidedly concave when the animal is contracted.

Colour of back dark grey (in spirit), with conspicuous white patches, including an irregular band along the middle of the back, an irregular patch on the right side towards the hinder end, and usually some smaller white patches. The tops of the more prominent papillae, and the comparatively large marginal swellings, are also white. Foot slightly tinged with yellow; hyponotum uniformly white.

Internal structure differing from that of *O. capensis* in that the skin is slightly thicker; the pulmonary network appears to be a little coarser; the albumen glands in the specimens examined were rather larger, and the receptaculum seminis was smaller; the vagina seems to be slightly longer, with a more prominent lateral protuberance; the vaginal gland is probably slightly more swollen distally; and the central teeth of the radula are decidedly broader and shorter. The radula itself is relatively a little shorter than that of *O. capensis*, measuring about 1.8×0.85 mm. when flattened out, and has the following formula (average of three specimens): $(86+1+86) \times 68$.

Habitat.—On rocks at St. James, Kalk Bay, in False Bay, where a number of specimens were found among barnacles, in January 1903, by Mr. R. M. Lightfoot, who states that the species was very local.

Type in the South African Museum, Cape Town.

Onchidella capensis, n. sp.

(Plate XXVII, figs. 4–11; Plate XXVIII, figs. 12, 14;
Plate XXXI, fig. 58.)

Size of type specimen from Green Point, 7.5 mm. long, 5.9 mm. broad, and 3.5 mm. high in the middle. Specimens from Sea Point are slightly smaller, though full-grown.

Form broadly oval. Back strongly arched—very much so in contracted specimens—and bearing numerous papillae, which are rather more crowded than in *O. pulchella*, but of which the larger are less prominent. Marginal glands usually about 24 in number, their positions being indicated by small swellings round the mantle-edge. Hyponotum rather broad and flat, usually becoming slightly concave when the animal is contracted, though not often so concave as in contracted specimens of the last species.

Colour of back grey (in spirit), sometimes rather dark, but generally with somewhat paler, very irregular and ill-defined patches, chiefly

situated towards the middle of the back. The tops of the larger papillae and the small marginal swellings are also pale. Foot tinged with yellow; hyponotum whitish, except at the hinder end near the opening of the mantle-cavity, where it is strongly tinged with grey in the typical form of this species.

Internal structure differing from that of *O. pulchella* in that the skin is slightly thinner, notwithstanding the larger size of the animal; the pulmonary network appears to be a little finer; the albumen glands in the specimens examined were rather smaller, and the receptaculum seminis was larger; the vagina seems to be slightly shorter relatively to the size of the animal, with a rather less prominent lateral protuberance; the vaginal gland is probably slightly less swollen distally; and the central teeth of the radula are decidedly longer and narrower. The radula itself is longer than in *O. pulchella*, measuring, when flattened out, about 2.6×1 mm. in specimens of medium size; and it has the following formula (average of four specimens): $(110+1+109) \times 80$.

Habitat.—Green Point, near Cape Town, where eight specimens were collected in June 1896 by Dr. W. F. Purcell.* This should be regarded as the type locality. A number of other specimens were found by Dr. K. H. Barnard, in April 1914, at Sea Point, near Cape Town, “on the rocks above high-water mark (except exceptional spring tides) but within reach of the spray, and mostly on the shady and protected sides, which do not dry up between one tide and the next.”

Type in the South African Museum, Cape Town.

Onchidella capensis var. *paucidentata*, n. var.

External features similar to those of the typical form of the species, except in the following particulars: the animal is slightly smaller, a somewhat contracted specimen measuring 5.8 mm. long, 4.9 mm. broad, and 3.5 mm. high in the middle; the papillae on the back are a little more prominent (though they are rather crowded, and the larger ones not quite so prominent as in *O. pulchella*); and the hyponotum is uniformly whitish, without the grey area at the hinder end.

Internal structure resembling that of the typical form of the species, except that in the radula, which measures about 2.3×0.9 mm. when flattened out, the central teeth, though not so short and broad as in *O. pulchella*, are a little shorter and broader than in the typical

* These are the specimens that Collinge identified as *Onchidium peroni* Cuv. (Ann. S. Afr. Mus., vol. ii, 1900, p. 7).

form of *O. capensis* (Plate XXVIII, fig. 13), and the total number of teeth is smaller, the following being the radular formula (average of three specimens): $(78+1+77) \times 72$.

Habitat.—Buffels Bay, near Cape Point, in False Bay, where several specimens, some of which were immature, were found by Dr. K. H. Barnard, in March 1915, "between and in empty barnacles (*Tetrachita*) at half-tide."

Type of the variety in the South African Museum, Cape Town.

AFFINITIES BETWEEN THE SPECIES OF *ONCHIDELLA* FOUND AT THE CAPE AND IN OTHER PARTS OF THE WORLD.

Mutual Relations of the Forms found at the Cape and in South-West Africa.—It will be noticed from the description given above that the slugs from Buffels Bay are in some respects intermediate between the typical form of *O. capensis* from near Cape Town and *O. pulchella* from near Kalk Bay; but while Buffels Bay is very much nearer to Kalk Bay than to Cape Town, the slugs from the first-mentioned locality resemble the typical *O. capensis* far more closely than they resemble *O. pulchella*. In fact, there can be little doubt that the Buffels Bay specimens merely constitute a local race or variety of *O. capensis*, with which species they have so very much in common; although the absence of the dark area at the hinder end of the hypnotum renders this variety easy to distinguish when the animals are turned upside down, without it being necessary to extract their radulae and count the teeth.

On the other hand, specimens of *O. pulchella* can be distinguished at a glance by their narrower form and much more conspicuous markings, and they also differ from *O. capensis* and its variety in several other respects, internal as well as external, as may be seen from the description. Therefore there can be no reasonable doubt that this form, from St. James, Kalk Bay, should be regarded as a distinct species. Nevertheless, the anatomical differences that separate *O. pulchella* and *O. capensis* are by no means important, and the internal organs of the two species are in most respects remarkably similar. It is therefore evident that *O. pulchella* and *O. capensis* are very closely related species.

These two species, found within a comparatively short distance of each other on the shores of the Cape Peninsula, are the only members of the genus *Onchidella* at present known to occur in Africa south of the equator, with the exception of *O. maculata* Plate, from Angra

Pequena in South-West Africa, about 550 miles north-north-west of Cape Town. According to Plate's description of this species,* it is somewhat larger than either of those from the Cape. In the colouring of the upper surface it seems to bear a considerable resemblance to *O. pulchella*; but in its strongly arched back and flattened dorsal papillae, and in the colouring of its lower surface, it more nearly approaches *O. capensis*. Internally *O. maculata* differs from both of the Cape species in having no vesicula seminalis, and apparently also in the vaginal gland arising opposite the receptacular duct instead of lower down on the vagina. But so far as it is possible to judge from Plate's description, *O. maculata* agrees closely with the Cape species in many other features of its anatomy, and there can be little doubt that it is closely allied to *O. pulchella* and *O. capensis*.

Resemblances and Differences between the Cape Species and those found elsewhere.—If we compare the South African species of *Onchidella* with those from other parts of the world, described anatomically by Semper,† Plate,‡ von Wissel,§ and others, we find that, while *O. reticulata* (Semper), from New South Wales, and *O. coquimbensis* Plate, from Chile, resemble *O. maculata* Plate in being without a vesicula seminalis, *O. nigricans* (Q. and G.), *petalloides* (Q. and G.), and *obscura* Plate, from New Zealand, *O. accrensis* Plate, from the Gold Coast, *O. marginata* (Couth. and Gould), and *juan-fernandeziana* Wiss., from South America, *O. borealis* Dall, from Alaska, and *O. celtica* (Cuv.), from Europe, all resemble *O. pulchella* and *O. capensis* in possessing this organ. In most of the better known species the vaginal gland is stated to arise opposite to the receptacular duct, as in *O. maculata* Plate; but it arises lower down, as in the Cape species, in *O. nigricans* (Q. and G.), from New Zealand—in which the vagina is unusually long—and in *O. coquimbensis* Plate, from Chile. The penis is always a comparatively simple organ, but *O. binneyi* Stearns, from the Gulf of California, *O. reticulata* (Semper), from New South Wales, and *O. nigricans* (Q. and G.) and *obscura* Plate, from New Zealand, seem to differ slightly from most of the other species in having the hinder end of the part containing concretions bent to one side. In

* Zool. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 201.

† Reis. Arch. Philipp., pt. 2, vol. iii, 1882, pp. 278–286.

‡ *Op. cit.*, pp. 201–208.

§ Zool. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, pp. 583–633; Zool. Jahrb. (Syst., Geogr. u. Biol.), vol. xx, 1904, pp. 662–669. References to the descriptions of the different species will be found on pp. 301–304 of the present work.

O. accrensis Plate, from the Gold Coast, the penial retractor arises a little further forwards than in the other species that have been examined; and in this form, as well as in *O. nigricans* (Q. and G.), from New Zealand, the radula-sac scarcely projects beyond the posterior end of the buccal mass. The hinder division of the liver is usually extremely small, as in the South African species; but it appears to be slightly larger in *O. accrensis* Plate, and in *O. nigricans* (Q. and G.), and perhaps also in *O. borealis* Dall, from Alaska; while it is decidedly larger in *O. celtica* (Cuv.), from Europe, and in *O. pachyderma* Plate, which probably comes from West Africa. The number of the marginal glands seems to vary from a dozen in *O. incisa* (Q. and G.), from Ascension Island, and about sixteen in *O. reticulata* (Semper), from New South Wales, to about thirty in *O. campbelli* Filhol, from near New Zealand, and *O. marginata* (Couth. and Gould), from Tierra del Fuego; but additional glands opening on the hyponotum have been described in some species, such as *O. reticulata* (Semper) and *O. juan-fernandeziana* Wiss. The inner surface of the body-wall is darkly pigmented in *O. patelloides* (Q. and G.), from New Zealand, *O. celtica* (Cuv.), from Europe, and *O. borealis* Dall, from Alaska; whereas *O. nigricans* (Q. and G.), *obscura* Plate, and *flavescens* Wiss., from New Zealand, *O. reticulata* (Semper), from New South Wales, and *O. marginata* (Couth. and Gould), *coquimbensis* Plate, and *juan-fernandeziana* Wiss., from South America, agree with all the known African species in that the body-wall has no inner layer of pigment. According to Plate, *O. maculata* Plate, from South-West Africa, and *O. celtica* (Cuv.), from Europe, differ from *O. accrensis* Plate, and *pachyderma* Plate, from tropical West Africa, *O. borealis* Dall, from Alaska, *O. reticulata* (Semper), from New South Wales, and *O. obscura* Plate, from New Zealand, in having a larger kidney, with fewer internal folds, and a less developed lung. In *O. borealis*, however, these organs seem to show some slight approach to the condition found in *O. maculata* and *O. celtica*, and it is probable that further connecting links between the two types occur among the South American species described anatomically by von Wissel and the South African forms dealt with in the present paper. Moreover, it is evident that this difference must be influenced to some extent by the relative state of expansion of the kidney and of the lung when the animals were killed and preserved.

Such is the character of the anatomical differences which separate the better known species of *Onchidella*. It will be noticed that these differences show very little correlation with one another, the Cape

forms agreeing most closely with different species according to the character which is taken as the criterion. Further, the differences show remarkably little relation to the geographical distribution of the various species. These facts, however, are less surprising when one observes how trivial most of these anatomical differences are, for not one of them can be regarded as having much systematic importance.

It is true that a comparative study of some of the papers that have been published dealing with the anatomy of various species of *Onchidella* might lead one to suppose that far more important differences occurred within the genus, but these alleged differences seem to be due to errors of observation. For example, the strikingly different accounts of the mantle-cavity in this genus* are certainly due to mistakes made by various writers on the subject, and not to any fundamental differences in the respiratory and excretory systems of the animals themselves. Similarly, the discrepancies between the various accounts of the accessory genital glands and the spermatheca in the midst of them are probably chiefly due to the ease with which these organs can be misunderstood, owing to the great difficulties involved in their dissection. Again, a comparison of the figures which have been published of the radulae of various species of *Onchidella* might lead one to suppose that great differences exist in this important organ, which is not the case. Von Wissel has given us much valuable information about the anatomy of *Onchidella*, but his figures of the radulae of the species with which his papers deal give a very inadequate idea of the true form of the teeth. Joyeux-Laffaie's drawings of the radula of *O. celtica* (Cuv.) are even worse. Binney's figures of the radulae of *O. borealis* Dall and *floridana* (Dall) are better in some respects, but they are seriously misleading in that they show the inner cusp of the lateral teeth to be very small, and the outer cusp to be very large. In the Onchidiidae it is always the inner cusp that is large, and the outer cusp that is very small, the former constituting the mesocone and the latter the ectocone, and specimens of the radulae of *O. borealis* and *floridana*, mounted by the late Professor Gwatkin, and given by him to the Cambridge University Museum of Zoology, show that neither of these species forms an exception to the rule. It is true that in these two slugs the teeth are slightly broader and rather less specialised in character than those of the species from South Africa, Australia, and New Zealand, but they agree with them in all their more important features. From Binney's description and

* See p. 248.

figure of the jaw of *O. borealis* Dall, one might also suppose that this species differed considerably from the southern members of the genus in this organ; but Professor Gwatkin's slide demonstrates that this is not the case, for although the jaw is apparently a little better developed in *O. borealis* than in most members of the genus, it is of the same general type that we find in the other species, being not very unlike that of *O. patelloides* (Q. and G.) as depicted by von Wissel,* though perhaps slightly more compact. It has often been stated that certain species of *Onchidella* do not possess a jaw, but this also is very probably an error of observation, as, owing to the fact that it is very small and usually extremely delicate, the jaw is exceptionally difficult to find by the ordinary methods in this genus, although von Wissel was able to demonstrate its presence in all the species that he examined by means of serial sections, even when he could not discover it otherwise. The exact position of the external openings is rightly regarded as of considerable systematic importance in the Onchidiidae; when, therefore, we notice that Stearns has twice stated that in *O. binneyi*—the form found by Fisher in the Gulf of California, and at first identified as *O. carpenteri* (Binney)—the respiratory orifice is "on the left side . . . at a point about two-fifths of the total length from the posterior end," and that the anus is on the right of the posterior extremity of the foot, his statements being confirmed by a figure,† we are apt to think that here at last is an important difference among the species of *Onchidella*, and that the South African forms cannot be at all nearly related to *O. binneyi* Stearns, whatever their affinities may be with other species. But it is not so; for Semper has already shown that the respiratory and other openings occupy their normal positions in this Californian species.‡ Possibly Stearns examined an abnormal or damaged specimen.

Very little is at present known about the anatomy of several species of *Onchidella*, and it is quite possible that when these forms have been investigated some of them may prove to differ in important respects from those that have been more adequately studied. It is clear, however, that there have not yet been discovered any differential characters of sufficient systematic importance to enable us to arrange the species of *Onchidella* in natural groups which might show their mutual genetic relations.

* Zool. Jahrb. (Syst., Geogr. u. Biol.), vol. xx, 1904, pl. xxv, fig. 77.

† Proc. Acad. Nat. Sci. Phila. (1878), 1879, pl. vii, fig. 7.

‡ Reis. Arch. Philipp., pt. 2, vol. iii, 1882, p. 281, pl. xxi, fig. 26.

Dr. Dall's Subdivision of ONCHIDELLA.—Notwithstanding the facts mentioned above, Dr. Dall of Washington, in his paper on the “Land and Fresh-water Mollusks of Alaska,” proposed the new section *Arctonchis* for *O. borealis*, *O. celtica*, and possibly other small boreal species of *Onchidella*, designating *O. borealis* Dall, from the north-west coast of America, as the type species.* From *Onchidella s.s.*—of which the type is *O. nigricans* (Q. and G.), from New Zealand,† Dall states that *Arctonchis* differs in the animal being “without muciparous glands on the lower side of the mantle, without dorsal eyes, and with a jaw.” As both of the Cape species of *Onchidella* agree with *Arctonchis* in all three of these characters, it is evident that they must both be assigned to this section, if Dall's classification is to be adopted. But if we consider the characters by which Dall states that *Arctonchis* is to be separated from *Onchidella s.s.*, it will be clear that his classification is not well founded.

First, as regards the absence of the glands that open on the lower surface of the mantle, or hyponotum. Whether these glands are present in *O. nigricans* (Q. and G.) appears to be uncertain; but, in any case, von Wissel has shown that in those species in which they have been found their number varies so much, even in different specimens of the same species, that they can have but little systematic importance.‡ For example, in one of the two specimens of *O. coquimbensis* Plate which he examined only two of these glands were present, while the other example possessed only a single gland on the left side and none on the right; one-half of this slug might, therefore, be placed in *Arctonchis* and the other in *Onchidella s.s.*, if the presence or absence of these glands is to be regarded as a distinguishing character.

The second feature in which Dall states that *Arctonchis* differs from *Onchidella s.s.* is the absence of dorsal eyes. But no dorsal eyes have been found in *O. nigricans* (Q. and G.), or in any other species of *Onchidella* of which we know the anatomy. Indeed, Plate, Stantschinsky, and other competent writers affirm that dorsal eyes

* “Alaska,” vol. xiii, 1905 (republished in 1910 by the Smithsonian Institution), p. 112.

† Dall states that *O. nigricans* was “selected as type by Herrmannsen, Ind. Gen. Mal., Suppl., 1852.” But Herrmannsen merely says (on p. 96): “**Onchidella** Gray 1850 Fig. iv. 117, g. Onchidium : *Onchidium nigricans* Q., etc.”; and this scarcely amounts to the selection of a type according to the International Rules. *O. nigricans* (Q. & G.), however, was definitely stated to be the type of *Onchidella* by Fischer and Crosse (Mission Scient. Mexique et Amér. Centr., Zool., pt. 7, vol. i, 1878, p. 687).

‡ Zool. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, p. 598.

never occur in this genus. It is true that Dall stated that dorsal eyes appeared to be present in *O. floridana* (Dall) ; * but Arey and Crozier say they have ascertained that "mantle eyes are absent in this species" ; † and even if they had occurred it would not have altered the fact that there is no difference in this respect between *O. borealis* Dall—the type of *Arctonchis*—and the typical members of the genus *Onchidella*.

Thirdly, Dall asserts that *O. borealis* differs from "all the other species of the family now known (except *O. celticum*)" in possessing a thin and delicate jaw, the others being agnathous. Yet already, before Dall's paper was first published, von Wissel had found a jaw in six other species of *Onchidella*, including the type *O. nigricans* (Q. and G.), and had further made the very reasonable suggestion that it was not unlikely that a jaw would be found in all the species of *Onchidella* when they came to be adequately studied by means of serial sections.‡

Enough has been said to prove that Dall's classification of these slugs is founded on ignorance of the true facts, and that it should be ignored. There is at present no good reason for supposing that the Cape species of *Onchidella* are in any way more nearly related to *O. borealis* Dall, from Alaska, than to the type of the genus from New Zealand.

GEOGRAPHICAL DISTRIBUTION OF THE GENUS.

(Plate XXXII.)

Misconceptions caused by Narrow Views on Distribution.—It seems possible that when Dall suggested dividing the genus *Onchidella* in the manner just described, he allowed himself to be influenced by geographical considerations ; for it is very unusual for pulmonate Gastropods found in Alaska or in England to be at all nearly related to those indigenous to New Zealand or the Tropics. Snails and slugs occurring in widely separated regions generally prove to belong to different groups, even when they have some superficial resemblance to one another ; and certain writers appear to hold the view that this must always be the case. They then fall into the error of asserting that differences occur between such forms, when a little investigation would have shown them that these differences had never been discovered or were actually known not to exist.

* Proc. U.S. Nat. Mus., vol. viii, 1885, p. 289.

† Journ. Gen. Physiol., vol. ii, 1919, p. 108 ; and Journ. Exper. Zool., vol. xxxii, 1921, pp. 466, 498.

‡ Zool. Jahrb. (Syst., Geogr. u. Biol.), vol. xx, 1904, p. 669.

A single example will suffice to demonstrate that it is not only among American scientists that misconceptions of this kind have sometimes arisen.

The fresh-water genus *Isidora* (Ehrenberg)—or *Bulinus* (Müll.), as it should perhaps be more correctly named—will be familiar to all students of the South African Mollusca, and has recently acquired an unpleasant notoriety on account of its connection with the human parasite *Bilharzia*. Its distribution extends northwards from the Cape as far as the Mediterranean region, and eastwards not only to the island of Madagascar, but as far as the East Indies, Australia, and New Zealand, while in India some large fossil shells have been found which probably belong to the same genus. Kennard and Woodward, however, appear to think that it is “misleading and mischievous” to suppose that the genus can have so wide a range, and they accordingly maintain that the species from Australia and New Zealand should be placed in separate genera from the African species.* They endeavour to justify this procedure by stating that a comparison of Jickeli’s figures of the radulae of the African forms with those that Dr. Cooke gave of several Australian species shows the existence of certain differences which they think might be considered sufficient to separate these forms generically. If, however, they had compared the radulae themselves they would have seen that Cooke was perfectly right when he said that the type of radula found in the Australian forms was so very like that found in the African species that “the resemblance amounts to identity.”† Indeed, the radulae of the Australian species appear to differ more among themselves than they do from either the African or the New Zealand forms. The shells from the different regions show no essential differences; and Pelseneer has demonstrated that species from Tasmania and New Zealand possess the characteristic folded branchial lobe which he found in a form from Madagascar,‡ and which the present writer has found in various African species of *Isidora*. Therefore, until the presence of important differences in some of the other organs has been demonstrated, there would seem to be no justification for dismembering the genus in the manner suggested.

Instead of splitting up genera in accordance with preconceived theories on geographical distribution, and then trying to make the facts agree with this procedure by asserting that differences exist

* Proc. Malac. Soc., vol. xiv, 1920, pp. 86, 88.

† Proc. Zool. Soc., 1889, p. 140.

‡ Arch. de Biol., vol. xiv, 1896, pp. 365, 372.

which, on investigation, prove to be imaginary, it would seem better to accept the facts so far as they are known, and then to try to explain them by considering why some genera of Pulmonates, such as *Onchidella*, should, apparently, be so very much more widely distributed than is usually the case.

Factors Determining Distribution.—Much has been written on the factors which cause and control the geographical distribution of animals and plants. One recent writer has maintained that the age of a group is the main factor which determines the size of the area over which it extends. Another would emphasise the importance of the struggle for existence between forms of similar habits, and the power which a dominant form may possess of expelling older and weaker species from the areas into which it spreads. A third sees in the gradual changes of climate which have taken place the main factor which has induced animals to wander far from their ancestral homes. Others again would lay stress on geological changes, and would explain the presence of a group of land animals on separate continents by assuming the existence of a former land-connection between them, which later became submerged beneath the sea; or would even suggest that when the group was first evolved the continents were contiguous, and that they afterwards drifted apart, carrying the animals with them.

This is not the place to discuss these theories in detail; suffice it to say that while many of them undoubtedly contain much truth, most of them seem to lay too much emphasis on one of the factors influencing the distribution of organisms, and pay too little attention to other important factors. For a little consideration will show that the geographical distribution of animals and plants must be determined by the combined action of the following four distinct factors:—

First.—Age. It is evident that, on an average, the older a species or group of species is, the more widely it will have become distributed; for, obviously, it takes time for an animal or plant to spread. This important factor of age has recently been emphasised—perhaps over-emphasised—in a work by Dr. Willis.*

Secondly.—Fitness, or, more precisely, the relative power of an animal or plant to thrive and multiply rapidly in varying environments and in competition with other organisms. Every new form must possess a certain degree of fitness to become established at all. But one species, or group of species, may owe its survival merely to

* Age and Area, 1922.

the fact that it is peculiarly adapted to the special environment in which it was evolved ; whereas another may have survived because of its superior powers of rapid growth and reproduction, which it can maintain under a variety of conditions. Clearly the distribution of the first of these forms is likely to remain comparatively restricted ; while the second will probably soon spread far and wide, and may drive out, or even exterminate, some of the older forms with which it competes.

Thirdly.—Mobility. Other factors being equal, those organisms will be the most widely distributed that move rapidly from place to place during some stage in their life-history, either by means of their own exertions, or because they are adapted to being carried by the winds, flowing rivers, or ocean currents, or by other organisms with better powers of locomotion than they possess. Animals or plants which are not endowed with the means of moving any distance, either actively or passively, at any stage in their development, will clearly have much difficulty in spreading. The great importance of this factor is so very obvious that it is surprising that it has not always received as much attention as it appears to deserve.

Lastly.—The absence of isolation of the locality in which a group of animals or plants is evolved will favour the distribution of that group. The importance of climatic and other physical barriers, however, is recognised by nearly all writers on this subject, and little need therefore be said about it here. Obviously a group that has been evolved on a remote island, for example, or on a cold isolated mountain-top, will have greater difficulty in spreading than one that has arisen in the middle of an extensive belt of country with a uniform climate. But it should never be forgotten that we must take into consideration any changes in the geographical or climatic conditions which are likely to have taken place at any time since the group was first evolved ; for there is, of course, good evidence that important physical barriers have been formed, and others have broken down, within the time that has elapsed since many groups originated.

It is well known that the extent to which each of these four factors is possessed by different groups of animals or plants may vary greatly, even among groups which are closely related. We should, therefore, expect to find an enormous variation in the size of the areas occupied by different genera. And if it could be shown that the genus *Onchidella* possesses some of these factors in a higher degree than most genera of slugs, it would be surprising if it had not an unusually wide distribution.

Probable Causes of the Wide Distribution of ONCHIDELLA.—As we do not know in what quarter of the globe the genus *Onchidella* arose, we cannot judge whether it was evolved in a locality which would specially favour its wide dispersal. We must, therefore, confine our attention to considering to what extent the genus possesses the first three factors mentioned above.

1. *Age.*—No fossil species of *Onchidella* are known to science, the genus being one which would not be at all likely to be preserved in a fossil state. We have, therefore, to rely on indirect evidence with regard to its age.

In studying the anatomy of this genus, one cannot help noticing the scarcity of transitional characters such as are so commonly found in other genera of pulmonate slugs—that is to say, the comparative scarcity of organs which seem to be in the process of developing or degenerating, or of changing their form. For example, in *Onchidella* (when full-grown) there is no longer the slightest trace of the shell or shell-sac; the detorsion of the alimentary canal and the respiratory organs has been completely effected, the anus and the respiratory orifice being always exactly in the middle at the hinder end of the animal; the characteristic marginal glands are probably as fully developed as they could be without interfering in any way with the other organs; the fusion of the pleural and parietal nerve-ganglia is complete, and the nerve-ring could scarcely become any narrower without unduly constricting the oesophagus. Thus, while the structure of most ordinary genera of slugs suggests that they cannot be very ancient, as if they were they would have developed further along the lines already begun, a study of the anatomy of *Onchidella* conveys no such impression, but rather suggests that the organisation of this genus is in a comparatively stable condition which may have been attained a long time ago. And although the genus is in many ways highly specialised, it retains certain archaic or primitive features in its nervous and digestive systems, which seem to indicate that it has arisen from a very ancient stock. There are, therefore, good grounds for thinking that the genus *Onchidella* is very possibly much older than most genera of pulmonate slugs, in which case it would have had time to become much more widely distributed.

2. *Fitness.*—It is very difficult to estimate to how great an extent an organism possesses the power to thrive and multiply under varying conditions, and to compete successfully with other organisms of similar habits. Yet the facts that the reproductive glands are very well developed in *Onchidella*, and the animals are usually very abundant where they occur at all, seem to indicate that the genus is

a prolific one.* Its power to live for a month or more under water, respiring through the skin,† or for the same period in the air (if not too dry), breathing mainly through the lung,‡ shows that it is quite exceptionally adaptable to a varying environment; and the same fact is indicated by the occurrence of the genus both on the equator and in the Bering Sea, and in the power that these animals possess of resisting comparatively high temperatures.§ The large marginal glands, or “poison glands” as they are sometimes termed, which are so characteristic of this genus, would seem to be well suited to protect the slugs from the attacks of other animals.|| They feed upon various small algae; and, as for any possible competition in the struggle for existence, the Onchidiidae is the only family of pulmonate slugs inhabiting the seashore. The other mollusks that occur in exactly the same type of locality as that in which these slugs are found are all so very different that it is doubtful whether any of them could be justly regarded as their serious competitors. Possibly, however, the other genera of the Onchidiidae might compete with *Onchidella*; for although the slugs belonging to these genera are undoubtedly more primitive in some respects, many of them are larger than the species of *Onchidella* and more highly organised in other ways. It is therefore hardly likely to be a mere coincidence that the only really extensive area in the world in which the genus *Onchidella* is not known to occur is that in which the other genera of the Onchidiidae are found, namely, the Indo-Pacific Region (see map, Plate XXXII).

The genus *Onchidium* (Buchanan)—including the subgenus *Oncis* (Plate)—is by far the largest and most widely distributed of the remaining genera of the Onchidiidae, the others being *Peronina* (Plate), from India, which is very closely related to *Onchidium*, and the rather more primitive genus *Oncidina* (Semper), from Queensland, New

* According to Joyeux-Laffaie, in *O. celtica* (Cuv.), pairing takes place throughout the spring and summer, it is reciprocal, and as many as seventy or eighty eggs are usually laid at a time (Arch. de Zool. Exper. et Génér., vol. x, 1882, pp. 330, 332).

† *Ibid.*, p. 280.

‡ Suter, Man. N.Z. Moll., 1913, p. 809. According to Barnard, *O. capensis* is found above ordinary high-water mark (see p. 284).

§ Arey and Crozier, Journ. Exper. Zool., vol. xxxii, 1921, pp. 474–476.

|| The effective way in which an *Onchidella* can repel another animal by discharging the acid secretion of its marginal glands has been shown by the interesting observations and experiments of Arey and Crozier (Amer. Natural., vol. liii, 1919, pp. 422–426; and Journ. Exper. Zool., vol. xxxii, 1921, pp. 456–459).

Caledonia, and the Fiji Islands. *Onchidium* occurs on the East coast of Africa, as well as elsewhere in the Indian Ocean, and its distribution extends in a south-westerly direction at least as far as Natal; but it has not been found at the Cape or in tropical West Africa, where the genus *Onchidella* occurs. In Australia *Onchidium* extends down the east coast as far south as the neighbourhood of Sydney, which is the northerly limit of the known distribution of *Onchidella* in that region. Passing eastwards, *Onchidium* occurs in several of the islands in the Pacific, and not improbably extends as far as the Galapagos Islands, where it again appears to meet the genus *Onchidella*; but more information is needed about the species from the Galapagos Islands before we can be certain of their generic relations. Outside of the Indo-Pacific Region, in the many areas where *Onchidella* is widely distributed, the genus *Onchidium* is not at present known to occur. It is true that Dall seems to regard *O. schrammi* (Bland and Binney), from Guadeloupe, as a typical *Onchidium*; * but Binney's original figure of the radula of this species agrees more nearly with the type of radula found in *Onchidella*,† and there is nothing in the description of the animal to suggest that it does not belong to the latter genus.‡ As regards *Oris ferussaci* Risso, from the South of France, a species which Bourguignat considered belonged to the Onchidiidae,§ it should be pointed out that Risso stated that this animal possesses four nearly equal tentacles, two mandibles, and other features which seem to show that it has no affinities with this family.||

On the other hand, not a single species of *Onchidella* is at present known to occur in the Indo-Pacific Region; for although Tapparone-Canefri ¶ and others have assigned certain species from this area to the genus *Onchidella*, Fischer and Crosse are probably right in thinking that these forms really belong to the genus *Onchidium*.** For it must not be forgotten that Gray's brief original description of *Onchidella* would apply to many species of *Onchidium* as well as *Onchidella*, and it was not until 1893 that the essential differences between the two genera were clearly set forth by Plate.††

It is true that in a paper written in 1915, and published so recently

* "Alaska," vol. xiii, 1905, p. 114.

† Ann. Lyceum Nat. Hist. New York, vol. x, 1874, pl. xvi, figs. 3-5.

‡ *Ibid.*, pp. 339, 340.

§ Étude Synonym. Moll. Alpes Marit. Risso, 1861, p. 27.

|| Hist. Nat. de l'Europe Merid., vol. iv, 1826, p. 57.

¶ Malac. in Zool. Viagg. Magenta (1865-68), 1874, p. 101, etc.

** Mission Scient. Mexique et Amér. Centr., Zool., pt. 7, vol. i, 1878, p. 696.

†† Zoolog. Jahrb. (Anat. u. Ontog.), vol. vii, pp. 164-167.

as 1920, Simroth described some new Onchidiidae from the Arru Islands in the Malay Archipelago, and regarded one of them as a species of *Onchidella*, naming it *Oncidium* (*Oncidiella*) *Mertoni*.* But he stated that the specimens were too hard for dissection, and his description and figures of their external features show none of the special characters by which the species of *Onchidella* can be distinguished from those belonging to the other genera of the Onchidiidae. On the contrary, they seem to show that this species differs from *Onchidella* in several respects; thus, the male opening appears to be further forward; the ciliated groove on the right of the foot seems to end posteriorly just behind the anus, instead of in it; the foot-sole is divided by numerous grooves into transverse ridges or "soleolae"; the hyponotum does not appear to be divided by a permanent hyponotal line into an outer papillated area and an inner smooth area; and the mantle-edge does not seem to show any outward indications of containing large marginal glands. It is therefore probable that Simroth was mistaken in regarding *O. mertoni* as an *Onchidella*; possibly it may prove to be a species of *Onchidium*. Consequently the occurrence of this species in the Arru Islands is not inconsistent with the statement that, although they are so widely distributed elsewhere, no species of *Onchidella* are known from the Indo-Pacific Region, where the other genera of the Onchidiidae occur.

It appears, therefore, that the wide dispersal of the genus *Onchidella* would be favoured not only by its probable age, but also because the animals seem to be prolific, exceptionally adaptable to varying conditions, with special means of protection from their enemies, and with no very close competitors within the extensive areas where they are found.

3. *Mobility*.—According to Hemphill, *Onchidella borealis* Dall moves quite rapidly for so small an animal.† On the other hand, Huppé states that *O. chilensis* moves with excessive slowness.‡ Arey and Crozier have shown that the rate of progression of *O. floridana* (Dall) is about 5 cm. per minute;§ but when the slugs leave the little clefts in the rocks which form their resting-places and move about, they afterwards return with a surprising regularity to the particular crannies whence they came,|| a fact which would

* Abhandl. hrsg. v. d. Senckenb. Naturf. Gesells. Frankfurt, vol. xxxv, p. 294.

† Binney, Bull. Mus. Comp. Zool., vol. xxii, 1892, p. 202.

‡ Gay's Historia de Chile, Zool., vol. viii, 1854, p. 121.

§ Journ. Exper. Zool., vol. xxxii, 1921, pp. 452, 471.

|| Proc. Nat. Acad. Sci. U.S.A., vol. iv, 1918, p. 319; and Journ. Exper. Zool., vol. xxxii, 1921, pp. 447-450, 484-488, 498.

not lead to their rapid dispersal. Moreover, the supposition that the slugs belonging to this genus are not accustomed to wander far on the shore is confirmed by the fact that they are usually found in narrowly circumscribed colonies. On the whole, therefore, it seems improbable that these animals would become more widely distributed than most slugs on account of any superior powers of locomotion that they might possess.

Joyeux-Laffuie has shown that in *O. celtica* (Cuv.) the young has the same general form as the adult when it emerges from the egg,* and it would therefore not be likely to have any greater mobility than the full-grown animal. But he has also shown that at an earlier stage in development the embryo assumes the form of a veliger larva, which moves about within the egg-shell; and although this larva now changes into a little slug before the egg is hatched, it is almost certain that in the ancestors of these animals the eggs must at one time have hatched earlier so that the larvae swam freely in the sea. Indeed, it is conceivable that even now hatching may precede the metamorphosis in some species of *Onchidella*; and if it does, or if it ever has done so since the genus was first evolved, it is obvious that it would favour the dispersal of the animals. Arey and Crozier state that in *O. floridana* (Dall) "the creature which emerges from the egg membrane has already the form of the adult,"† as in *O. celtica* (Cuv.); but it is very desirable that we should know something of the ontogeny of other species of *Onchidella*, and it is greatly to be hoped that some day a South African zoologist, who has the opportunity of studying living specimens of *O. pulchella* and *O. capensis*, will publish an account of the development of these interesting slugs.

But while it is very doubtful whether *Onchidella* is any more active than most snails and slugs, probably no other genus of pulmonate slugs is so well adapted to being carried across the sea by ocean currents in drift material, such as masses of empty barnacles, sponges, etc. It will be remembered that both of the Cape species have been found among barnacles,‡ and *O. celtica* (Cuv.) sometimes lays its eggs in empty barnacles according to Joyeux-Laffuie.§ On the other hand, Huppé states that *O. lanuginosa*—a minute, little known species from Chile—lives amongst sponges.|| The transit of the slugs would be favoured by their small size, and especially by their power to live

* Arch. de Zool. Expér. et Génér., vol. x, 1882, pp. 333–369, pls. xx–xxii.

† Journ. Exper. Zool., 1921, vol. xxxii, p. 456.

‡ See pp. 283, 285.

§ Arch. de Zoologie Expér. et Génér., vol. x, 1882, p. 331.

|| Gay's Historia de Chile, Zool., vol. viii, 1854, p. 122.

either in damp air or entirely submerged in sea-water for weeks at a time. And the facts that they are strongly gregarious, hermaphrodite, with possible powers of self-fertilisation, and apparently, as we have already seen, well fitted to thrive and multiply in many different localities, would increase their chances of establishing colonies on any rocky shores on which they might be stranded. The view that these slugs are easily carried across the sea is also supported by the fact that the genus has been found on so many remote islands, such as Ascension Island, Bermuda, the Galapagos Islands, Juan Fernandez, Campbell Island, Auckland Island, and the Chatham Islands beyond New Zealand.

If these slugs are thus capable of being carried across the seas by the surface currents, aided by the accompanying winds blowing on the drifting material, the wide distribution of the genus can be easily explained; especially as it is very possible that the genus dates back to a time when some of the continents were more closely linked by islands than they are at present. From the east coast of Australia and Tasmania the animals would be carried at first southward by the East Australian Current, and then eastward by the West Wind Drift to New Zealand, Auckland Island, and Campbell Island. The same drift might then convey them by way of the Chatham Islands onwards to the coast of Chile. The Cape Horn Current would carry them to Tierra del Fuego, whence the West Wind Drift would again convey them eastwards as far as the Cape. They would spread northwards up the western coasts of both South America and Africa; but when they arrived in the Tropics the South Equatorial Current would be likely to carry some of them westwards from South America to the Galapagos Islands, and from Africa to Ascension Island, and thence to Brazil, and north-westwards to the West Indies and Florida. From here the Gulf Stream might carry them eastwards again, by way of the Bermuda Islands, to Europe.

Enough has been said to show that there are good reasons for supposing that the genus *Onchidella* possesses in a much higher degree than the majority of slugs most of those factors which favour a wide geographical distribution. It is, therefore, not at all surprising to find that the genus appears to have a wider natural distribution than any other genus of pulmonate slugs known to science. And it is in complete accord with the principles of geographical distribution as applied to this genus that undoubted species of *Onchidella* should have been discovered living in the neighbourhood of Cape Town by the zoologists of the South African Museum.

ALPHABETICAL LIST OF THE KNOWN SPECIES OF *ONCHIDELLA*,
WITH REFERENCES.

The difficulty of compiling a list of the species of *Onchidella* is increased by the fact that many species of the Onchidiidae have not been described in a sufficiently precise manner to enable one to determine in which genus they should be placed. Therefore, in the present state of our knowledge, it is impossible to affirm definitely that every one of the species included in the following list certainly belongs to the genus *Onchidella*, and that all of the named forms which have been excluded from the list undoubtedly belong to other genera. Moreover, it is possible, though by no means probable, that one or two other names besides those indicated in the footnotes may eventually prove to be synonyms. Only the more important references are given, minor references of little interest being usually omitted.

- O. accrensis*, Plate, Zool. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 203, pl. xii, fig. 100. *Hab.*—Gold Coast, West Africa.
- O. armadilla* (Mörch), Journ. de Conchyl., vol. xi, 1863, p. 43. *Hab.*—St. Thomas and other West Indian Islands.
- O. binneyi* Stearns, Proc. U.S. Nat. Mus., vol. xvi (1893), 1894, p. 342, pl. 1, figs. 1, 2; Stearns, Proc. Acad. Nat. Sci. Phila. (1878), 1879, p. 399, pl. vii, figs. 7, 8 (as *O. carpenteri* Bin.); Semper, Reis. Arch. Philipp., pt. 2, vol. iii, 1882, p. 281, pl. xxi, figs. 14, 25, 26 (as *O. carpenteri* Bin.); Binney, Bull. Mus. Comp. Zool., vol. xix, 1890, p. 214, pl. vi, figs. D, E (as *O. carpenteri* Bin.). *Hab.*—Gulf of California.
- O. borealis* Dall, Amer. Journ. Conch., vol. vii, 1871, p. 135; Binney, Proc. Acad. Nat. Sci. Phila., 1876, p. 184, pl. vi, figs. E, BB, EE; Binney, Bull. Mus. Comp. Zool., vol. iv, 1878, p. 179, figs. 87, 88, pl. v, fig. B; Semper, Reis. Arch. Philipp., pt. 2, vol. iii, 1882, p. 282, pl. xxi, fig. 13; Binney, Man. Amer. Land Shells, Bull. No. 28 U.S. Nat. Mus., 1885, p. 162, figs. 147–149; Hemphill, in Binney, Bull. Mus. Comp. Zool., vol. xxii, 1892, p. 202; Plate, Zool. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 206; Dall, "Alaska," vol. xiii, 1905, p. 112. *Hab.*—Alaska and west coast of Canada and United States.
- O. campbelli* Filhol, Comptes Rendus Acad. Sci. Paris, vol. xci, 1880, p. 1094; Filhol, Miss. Sci. à l'Île Campbell, 1885, p. 521; Suter, Man. N.Z. Moll., 1913, p. 809; atlas (1915), pl. xxxii, figs. 1, a. *Hab.*—Campbell I., Auckland I., and Stewart I., south of New Zealand.
- O. capensis* Watson, n. sp., Ann. S. Afr. Mus., vol. xx, 1925, pp. 239, 283, pl. xxvii, figs. 4–11; pl. xxviii, figs. 12, 14; pl. xxxi, fig. 58; Collinge, Ann. S. Afr. Mus., vol. ii, 1900, p. 7 (as *Onchidium peroni* Cuv.). *Hab.*—Neighbourhood of Cape Town, South Africa.
- O. carpenteri* Binney, Proc. Acad. Nat. Sci. Phila., 1860, p. 154; Binney, Land and Fresh-water Shells of N. Amer., vol. i, 1868, p. 307, fig. 544; Fischer and Crosse, Mission Scient. Mexique et Amér. Centr., Zool., pt. 7, vol. i, 1878.

- p. 697; Binney, Man. Amer. Land Shells, Bull. No. 28 U.S. Nat. Mus., 1885, p. 163, fig. 150. *Hab.*—Lower California and west coast of United States.
- O. celtica* (Cuvier), Règne Animal, 1817, vol. ii, p. 411, and 1830, vol. iii, p. 46 (*nomen nudum*); Audouin and Milne-Edwards, Recherches Hist. Natur. du Littoral de la France, vol. i, 1832, p. 118; Forbes and Hanley, Hist. Brit. Moll., 1853, vol. i, pl. FFF, fig. 6; vol. iv, p. 3; Recluz, Actes Soc. Linn. Bordeaux, vol. xxvii, 1869, p. 59; Jeffreys, Brit. Conch., vol. v, 1869, p. 95, pl. iii, fig. 5; Vaillant, Comptes Rendus Acad. Sci. Paris, vol. lxxiii, 1871, p. 1172, and Bull. Soc. Philom., vol. viii, 1871, p. 225, and vol. ix, 1872, p. 25; Fischer and Crosse, Mission Scient. Mexique et Amér. Centr., Zool., pt. 7, vol. i, 1878, p. 687, pl. xxxi, figs. 1–12; Joyeux-Laffaie, Arch. de Zool. Expér. et Génér., vol. x, 1882, p. 225, pls. xiv–xxii; Semper, Reis. Arch. Philipp., pt. 2, vol. iii, 1882, p. 283, pl. xxi, fig. 21; Plate, Zool. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 202, pl. vii, figs. 11c, 22; pl. viii, fig. 32; pl. x, fig. 49a; Haller, Verhandl. Naturhist.-Medicin. Vereins Heidelberg, vol. v, 1894, p. 301; Boutan, Arch. de Zool. Expér. et Génér., ser. 3, vol. vii, 1899, p. 290, fig. 22; Vayssière, Encycl. Scient., Bibl. de Zool., Moll. de la France, vol. i, 1913, p. 388, pl. xli, fig. 11; Germain, *ibid.*, vol. ii, 1913, p. 227.* *Hab.*—Brittany and Cornwall.
- O. chilensis* (Huppé), Gay's Historia de Chile, Zool., vol. viii, 1854, p. 120; Plate, Sitz.-ber. Akad. Wissens. Berlin, 1894, p. 219. *Hab.*—Chiloe Island, Chile.
- O. coquimbensis* Plate,† Sitz.-ber. Akad. Wissens. Berlin, 1894, p. 218; von Wissel, Zool. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, p. 586, pl. xxxiv, figs. 3, 4, 10, 11a, 12b; pl. xxxvi, fig. 28. *Hab.*—Coquimbo, Chile.
- O. flavescentes* von Wissel, Zool. Jahrb. (Syst., Geogr. u. Biol.), vol. xx, 1904, p. 668, pl. xxv, figs. 78, 79; Suter, Man. N.Z. Moll., 1913, p. 810; atlas (1915), pl. xxxii, figs. 2, a. *Hab.*—Chatham Islands, and North Island, New Zealand.
- O. floridana* (Dall), Proc. U.S. Nat. Mus., vol. viii, 1885, p. 288; Binney, Bull. Mus. Comp. Zool., vol. xix, 1890, p. 203, pl. iii, fig. 10; pl. vi, figs. B, C; Pilsbry, Trans. Connect. Acad. Arts and Sci., vol. x, 1900, p. 503; Dall and Simpson, Bull. U.S. Fish Comm. 1900, vol. xx, pt. 1, 1901, p. 371; Arey and Crozier, Proc. Nat. Acad. Sci. U.S.A., vol. iv, 1918, p. 319; Amer. Natural., vol. liii, 1919, p. 415; Journ. Gen. Physiol., vol. ii, 1919, p. 107; Journ. Exper. Zool., vol. xxxii, 1921, p. 443.‡ *Hab.*—Florida, Bermuda, and Porto Rico.
- O. incisa* (Quoy and Gaimard), Voyage de l'Astrolabe, Zool., vol. ii, 1832, p. 211, pl. xv, figs. 19, 20. *Hab.*—Ascension Island.
- O. indolens* ((Couthouy) Gould), Wilkes U.S. Explor. Exped., vol. xii, Moll., 1852, p. 290; atlas (1856), pl. xxi, figs. 381–382a. *Hab.*—Brazil.
- O. irrorata* (Gould),§ Wilkes U.S. Explor. Exped., vol. xii, Moll., 1852, p. 291; atlas (1856), pl. xxi, figs. 383–383b; Suter, Man. N.Z. Moll., 1913, p. 811. *Hab.*—North Island, New Zealand.
- O. juan-fernandeziana* von Wissel, Zool. Jahrb., Suppl., vol. iv (Fauna Chilensis,

* See also under *O. tuberculata* ((Crouan) Taslé).

† It is possible that this form may not be specifically distinct from *O. chilensis* (Huppé).

‡ See also under *O. trans-atlantica* (Heilprin).

§ Perhaps not specifically distinct from *O. petalloides* (Q. and G.).

- vol. ij, 1898, p. 586, pl. xxxiv, figs. 1, 5, 8, 9, 12c; pl. xxxv; pl. xxxvi, figs. 22-24, 26, 29, 30. *Hab.*—Juan Fernandez, near Chile.
- O. lanuginosa* (Huppé), Gay's *Historia de Chile*, Zool., vol. viii, 1854, p. 121. *Hab.*—Chiloe Island, Chile.
- O. maculata*, Plate, Zool. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 201, pl. vii, fig. 4; pl. ix, figs. 43, 44; pl. x, figs. 45-49, 52; pl. xi, fig. 68; pl. xii, fig. 101. *Hab.*—Angra Pequena, S.W. Africa.
- O. marginata* ((Couthouy) Gould), Wilkes U.S. Explor. Exped., vol. xii, Moll., 1852, p. 292; atlas (1856), pl. xxii, figs. 386-386e; von Wissel, Zool. Jahrb., Suppl., vol. iv (Fauna Chilensis, vol. i), 1898, p. 586, pl. xxxiv, figs. 2, 6, 7, 11b, 12a; pl. xxxiv, figs. 25, 27. *Hab.*—Tierra del Fuego.
- O. nana* (Philippi)* *Fauna Molluscorum Siciliae*, vol. ii, 1844, p. 101, pl. xx, fig. 6; Jeffreys, Brit. Conch., vol. v, 1869, p. 96; Vayssière, *Encycl. Scient., Bibl. de Zool.*, Moll. de la France, vol. i, 1913, p. 388, pl. xli, fig. 9. *Hab.*—Sicily, Italy, and the South of France.
- O. nigricans* (Quoy and Gaimard), *Voyage de l'Astrolabe*, Zool., vol. ii, 1832, p. 214, pl. xv, figs. 24-26; Tryon, *Struct. and Syst. Conch.*, vol. iii, 1884, pl. cii, fig. 68; von Wissel, Zool. Jahrb. (Syst., Geogr. u. Biol.), vol. xx, 1904, p. 662, pl. xxv, figs. 70-74; Suter, *Man. N.Z. Moll.*, 1913, p. 811; atlas (1915), pl. xxxii, fig. 3. Additional references will be found in Suter's Manual (*loc. cit.*). *Hab.*—North and South Islands, New Zealand, and Chatham Islands.
- O. obscura* Plate, Zool. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 207; Suter, *Man. N.Z. Moll.*, 1913, p. 812. *Hab.*—D'Urville Island and South Island, New Zealand.
- O. pachyderma* Plate, Zool. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 204; Bretnall, *Rec. Australian Mus.*, vol. xii, 1919, p. 328. *Hab.*—Victoria, Cameroon (?), West Africa.
- O. parthenopeia* (delle Chiaje), *Descrizione d. Animali s. Vert. d. Sicilia*, vol. ii, 1841, p. 13, pl. xli; *Mem. di Fisica Soc. Ital.*, vol. xxiii (1843), 1844, p. 211, pl. iii; Semper, *Reis. Arch. Philipp.*, pt. 2, vol. iii, 1882, p. 285.† *Hab.*—Italy.
- O. patelloides* (Quoy and Gaimard), *Voyage de l'Astrolabe*, Zool., vol. ii, 1832, p. 212, pl. xv, figs. 21-23; Hutton, *Trans. N.Z. Inst.*, vol. xiv, 1882, p. 155, pl. iv, figs. B, R; Pelseneer, *Mém. de l'Acad. Roy. de Belg.*, vol. liv, 1901, *Études Gastr. Pulmonés*, p. 20, pl. v, figs. 45, 46; pl. vi, figs. 47, 48; von Wissel, Zool. Jahrb. (Syst., Geogr. u. Biol.), vol. xx, 1904, p. 667, pl. xxv, figs. 75-77; Pelseneer, *Lanckester's Treatise on Zoology*, pt. v, Moll., 1906, p. 78, fig. 59; Suter, *Man. N.Z. Moll.*, 1913, p. 813; atlas (1915), pl. xxxii, fig. 4; Bretnall, *Rec. Australian Mus.*, vol. xii, 1919, p. 324. For further references see the last two works. *Hab.*—North and South Islands, New Zealand, and Chatham Islands.
- O. pulchella* Watson, n. sp., *Ann. S. Afr. Mus.*, vol. xx, 1925, pp. 239, 282, pl. xxvii, figs. 1-3; pl. xxviii, figs. 15-35; pls. xxix-xxxi. *Hab.*—Kalk Bay, Cape of Good Hope.
- O. reticulata* (Semper), *Reis. Arch. Philipp.*, pt. 2, vol. iii, 1880, pl. xx, fig. 16; pl. xxiii, fig. 1; and 1882, p. 278, pl. xxi, figs. 16, 20, 23; Plate, Zool. Jahrb. (Anat. u. Ontog.), vol. vii, 1893, p. 205, pl. xi, figs. 69, 70; Bretnall, *Rec.*

* Probably a synonym of *O. parthenopeia* (delle Chiaje).

† See also under *O. nana* (Philippi).

- Australian Mus., vol. xii, 1919, p. 324.* *Hab.*—New South Wales, Tasmania, and North Island, New Zealand (?).
- O. schrammi* (Bland and Binney), Ann. Lyceum Nat. Hist. New York, vol. x, 1874, p. 339, pl. xvi, figs. 3-5. *Hab.*—Guadeloupe, West Indies.
- O. steindachneri* (Semper), Reis. Arch. Philipp., pt. 2, vol. iii, 1880, pl. xix, figs. 7, 8; pl. xxiii, fig. 14; and 1882, p. 280, pl. xxi, fig. 15; Stearns, Proc. U.S. Nat. Mus., vol. xvi (1893), 1894, p. 384, pl. li, figs. 4, 5. *Hab.*—Galapagos Islands.
- O. trans-atlantica* (Heilprin),† Proc. Acad. Nat. Sci. Phila. (1888), 1889, p. 327, pl. xvi, figs. 4, 4a; Heilprin, "Bermuda Islands," 1893, p. 187, pl. xv, figs. 4, 4a; Pilsbry, Trans. Connect. Acad. Arts and Sci., vol. x, 1900, p. 503. *Hab.*—Bermuda Islands.
- O. tuberculata* ((Crouan) Taslé),‡ Faune Malac. Marine de l'Ouest de la France, Catal. Moll. Atlantique Français, Suppl., 1870, p. 49; Fischer, Journ. de Conchyl., vol. xix, 1871, p. 370. *Hab.*—Finistère, Brittany.

* I cannot agree with Bretnall in regarding *O. reticulata* (Semper) as synonymous with *O. patelloides* (Q. and G.), because a comparison of Plate's description of some of Semper's original specimens of *O. reticulata*, from Sydney, with von Wissel's account of examples of *O. patelloides*, from New Zealand and the Chatham Islands, shows that the two forms differ in their anatomy. Thus, *O. reticulata* is stated to have the inner surface of the body-wall unpigmented, and to be without a vesicula seminalis; whereas in *O. patelloides* the inner surface of the body-wall is darkly pigmented, and the vesicula seminalis is well developed. It seems to be possible, however, that the specimens from New Zealand, which Semper also included in his species, may prove to be more correctly assigned to *O. patelloides*. Suter does not include *O. reticulata* among the species found in New Zealand.

† Now considered to be synonymous with *O. floridana* (Dall) (*q.v.*). It should be noted, however, that in addition to this species, another much smaller species of *Onchidella* also occurs abundantly at Bermuda, having been recorded, but not named, by Crozier and Arey (Amer. Natural., vol. liii, 1919, pp. 417, 427; Journ. Exper. Zool., vol. xxxii, 1921, p. 446).

‡ Almost certainly a synonym of *O. celtica* (Cuv.).

EXPLANATION OF PLATES.

ABBREVIATIONS.

- abd. gn.* = abdominal ganglion.
alb. gl. = albumen glands.
ant. liver = anterior division of liver.
buc. cav. = buccal cavity.
buc. com. = buccal commissure.
buc. wall = wall of buccal mass.
cer. com. = cerebral commissure.
herm. d. = hermaphrodite duct.
herm. gl. = hermaphrodite gland.
int. (a) = first part of intestine passing forwards from the stomach.
int. (b) = second part of intestine passing backwards to the rectum.
l. ant. b. protr. = left anterior buccal protractor.
l. buc. gn. = left buccal ganglion.
l. cer. gn. = left cerebral ganglion.
l. eye = left eye.
l. hep. d. = hepatic duct from left anterior portion of liver.
l. lab. palp. = left labial palp.
l. lat. sin. = left lateral sinus.
l. ped. gn. = left pedal ganglion.
l. pl.-par. gn. = left pleuro-parietal ganglion.
l. sal. d. = left salivary duct.
l. sal. gl. = left salivary gland.
l. tent. = left tentacle.
l. tent. retr. = left tentacular retractor muscle.
long. vn. = lateral longitudinal vein passing backwards on each side dorsal to the lateral sinus.
marg. gl. = marginal gland.
marg. gl. d. = duct of marginal gland.
odont. art. = odontophoral artery.
odont. n. = odontophoral nerves.
odont. sup. = odontophoral support.
oesoph. = oesophagus.
osphr. = vestigial osphradium.
p. ped. com. = posterior pedal commissure.
pap. = papilla projecting into the cavity of the buccal mass just behind the opening of the oesophagus.
ped. gl. = pedal gland.
pen. op. = opening of penis.
pen.-pap. = penis-papilla.
pen. retr. = penial retractor.
pericard. = pericardium.
post. buc. m. = posterior ventral buccal muscles.
post. hep. d. = opening of the posterior hepatic duct into the hinder end of the stomach.

- post. liver* = posterior division of the liver.
prost. ap. = appendix of spermoviduct or prostate gland.
prost. ap. (b) = proximal end of the same organ, showing its junction with the spermoviduct.
r. ant. b. protr. = right anterior buccal protractor.
r. buc. gn. = right buccal ganglion.
r. cer. gn. = right cerebral ganglion.
r. eye = right eye.
r. hep. d. = right hepatic duct.
r. lab. palp = right labial palp.
r. lat. sin. = right lateral sinus.
r. ped. gn. = right pedal ganglion.
r. pl.-par. gn. = right pleuro-parietal ganglion.
r. sal. d. = right salivary duct.
r. sal. gl. = right salivary gland.
r. spov. gl. = right spermoviduct gland.
r. tent. = right tentacle.
r. tent. retr. = right tentacular retractor muscle.
rad. sac. = radula-sac.
rad. retr. = radular retractor muscles.
rec. sem. = receptaculum seminis.
recept. d. = receptacular duct.
resp. op. = opening of lung.
spermov. = spermoviduct.
stom. (f.) = first part of stomach.
stom. (l.) = last part of stomach.
stom. (m.) = wall of muscular part of stomach.
stom. (p.) = posterior part of stomach.
subcer. com. = subcerebral commissure.
vag. gl. = vaginal gland.
vag. gl. d. = duct of vaginal gland.
vag. op. = opening of vagina.
vas def. = vas deferens.
ventr. rad. pkt. = ventral pocket containing anterior end of radula.
ves. sem. = vesicula seminalis.
visc. art. = visceral artery to stomach, liver, etc.

 PLATE XXVII.
Onchidella pulchella.

FIG.

1. Right side of animal. ×6.
2. Dorsal surface. ×6.
3. Ventral surface. ×6.

Onchidella capensis.

4. Right side of animal. ×6.
5. Dorsal surface. ×6.
6. Ventral surface. ×6.
7. Dorsal view of viscera. ×10.

FIG.

8. Wall of oesophagus (stained), seen from within. $\times 60$.
9. Ventral view of pedal ganglia. $\times 24$.
10. Central nervous system. $\times 30$.
11. Genital organs. $\times 18$.

PLATE XXVIII.

Onchidella capensis.

12. Buccal mass, right salivary gland, oesophagus, crop, stomach, and intestine, seen from the right side after the removal of the rectum, liver, etc. $\times 21$.
13. Central tooth from the radula of the variety *paucidentata*. $\times 875$.
14. Representative teeth from the radula of a specimen from Sea Point. $\times 875$.

Onchidella pulchella.

15. Representative teeth from the radula. $\times 875$.
16. A single lateral tooth from the radula, seen from the side. $\times 875$.
17. Section of the epithelium lining of the buccal cavity. $\times 350$.
18. Section of the buccal epithelium near the opening of the oesophagus. $\times 350$.
19. Longitudinal section of the wall of the oesophagus. $\times 350$.
20. Transverse section of the wall of the crop. $\times 350$.
21. Transverse section of the wall of the intestine. $\times 350$.
22. Transverse section of the wall of the division of the stomach lying in front of the muscular portion. $\times 350$.
23. Transverse section of the lateral wall of the muscular part of the stomach. $\times 350$.
24. Transverse section of the wall of one of the larger anterior hepatic ducts. $\times 350$.
25. Transverse section of the wall of the spermooviduct, showing the transition from the glandular to the non-glandular part. $\times 350$.
26. Transverse section of the wall of the free oviduct. $\times 350$.
27. Section of the wall of the appendix of the spermooviduct or prostate gland. $\times 350$.
28. Section of wall of the receptaculum seminis. $\times 350$.
29. Transverse section through the vestigial osphradium, and the adjacent right posterior pallial nerve. $\times 350$.
30. Transverse section through the part of the vas deferens lying in the body-cavity near the penis. $\times 350$.
31. Transverse section of the wall of the vas deferens in the posterior part of the body-cavity near the oviduct. $\times 350$.
32. Transverse section of the wall of the aorta. $\times 350$.
33. Transverse section of the wall of the vaginal gland. $\times 350$.
34. Section of the wall of the penis. $\times 350$.
35. Transverse section through the last portion of the vas deferens embedded in the penial retractor muscle. $\times 350$.

PLATES XXIXA, XXIXB, XXIXC.

Onchidella pulchella.

- 36-44. Serial transverse sections through the anterior and middle parts of the animal. $\times 24$. The sections are arranged in order from before backwards, and are seen from the front, the right side of the animal being on the left side in the figures.

PLATES XXXA, XXXB.

Onchidella pulchella.

FIG.

- 45-50. Serial transverse sections through the hinder part of the animal. $\times 24$.
The sections are arranged in order from behind forwards, and are seen from behind, the right side of the animal being on the right in the figures.
51. Transverse section through a part of the body-wall, showing one of the dorsal papillae, and through a small portion of the liver. $\times 135$.
52. Transverse section through a part of the foot. $\times 150$.
53. Section through a small part of the kidney and of the lung (on the left), showing the difference between the excretory epithelium of the kidney and the pavement epithelium lining the lung. $\times 150$. The cavity to the right of the small branch of the kidney is that of the outer pulmonary vein, containing the chief auricular muscle.
54. Longitudinal section through the end of the retracted tentacle, with the right eye. $\times 135$.

PLATE XXXI.

Onchidella pulchella.

55. Transverse section through the anterior end of the radula-sac and the odontophoral support. $\times 100$.
56. Transverse section through the middle of the radula-sac and the part of the odontophoral support beneath it. $\times 100$.
57. Transverse section through the radula-sac towards the hinder end of the buccal mass. $\times 100$.

Onchidella capensis.

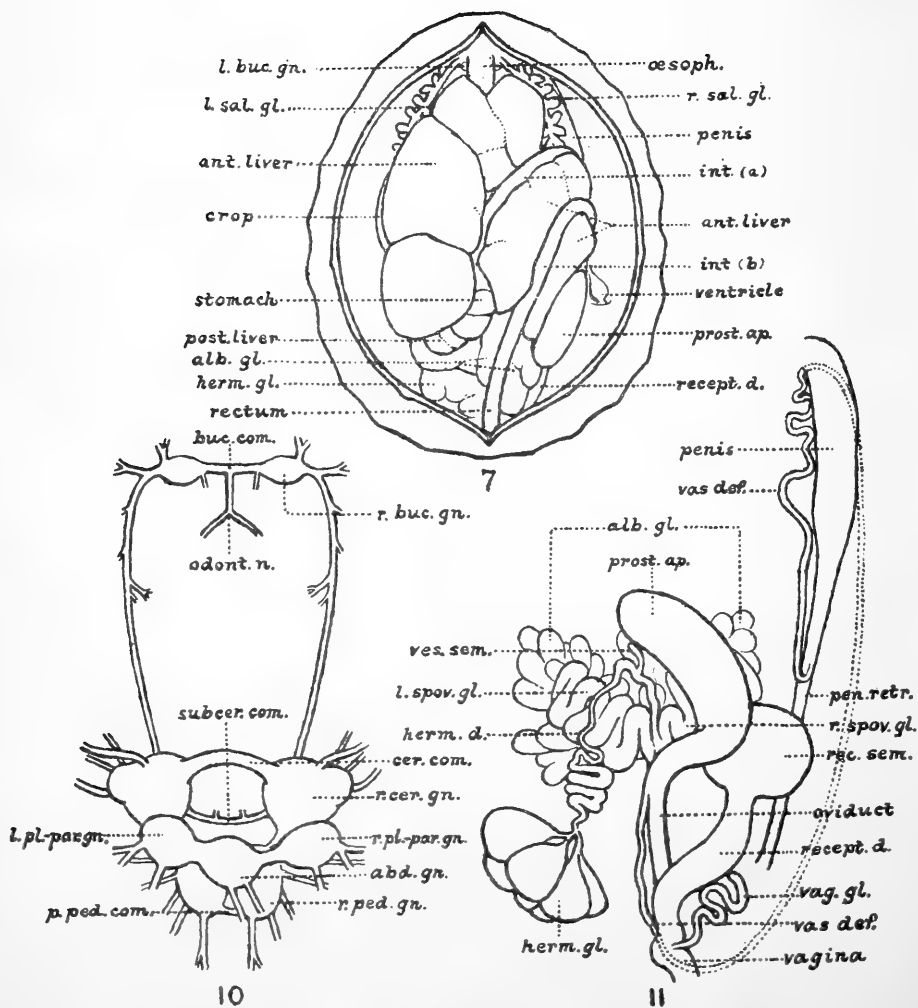
58. The middle part of the radula of a specimen from Green Point. $\times 135$.

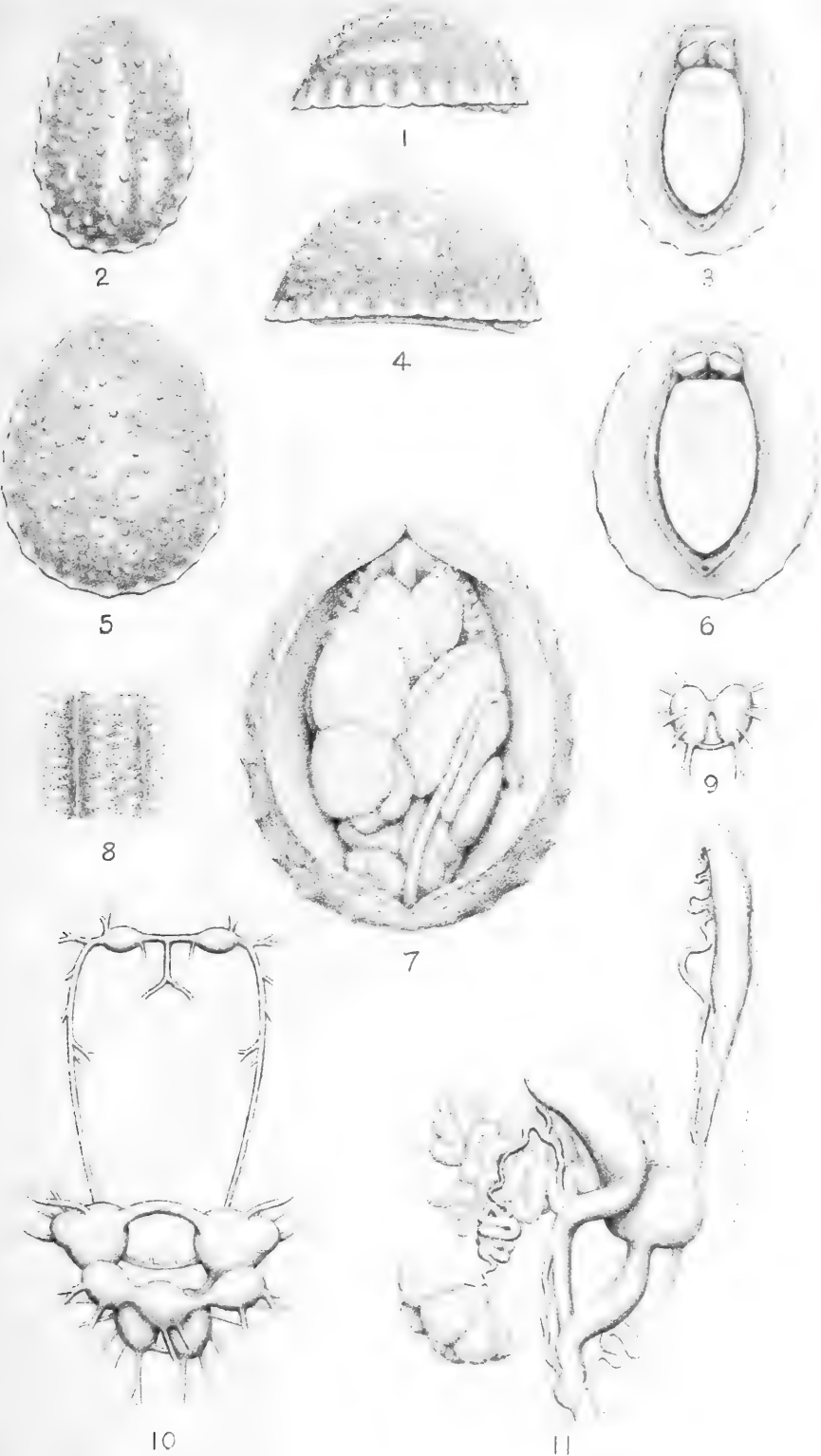
Onchidella pulchella.

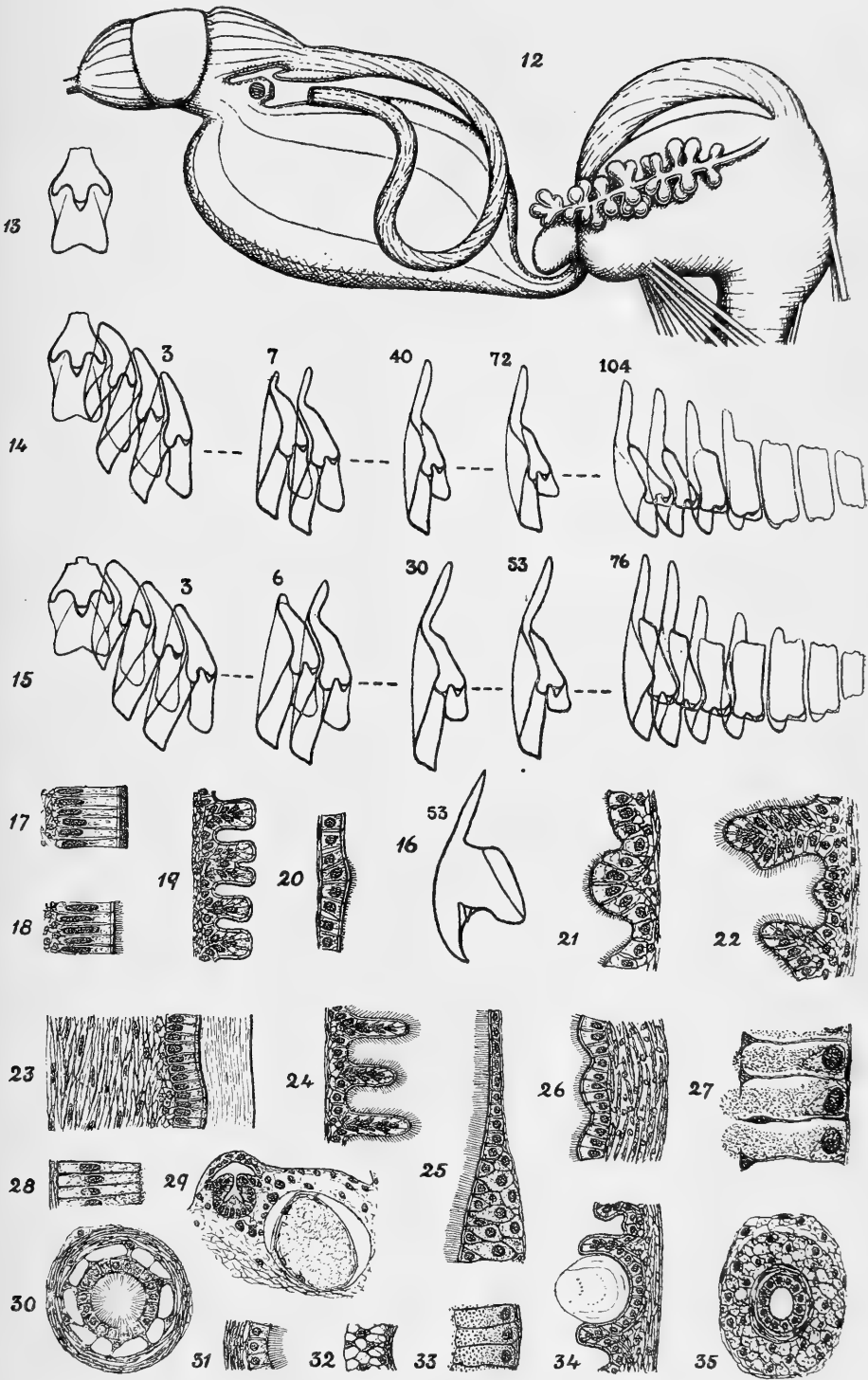
59. Section showing jaw and the adjacent buccal epithelium. $\times 120$.
60. Transverse section of the ciliated groove in the hyponotum close to the right side of the foot, with the vas deferens beside it. $\times 150$.
61. Section through a part of the right spermoviduct gland. $\times 135$.
62. Section through the right cerebral ganglion (seen from the front), showing the lateral lobe with its cavity. $\times 130$. The cerebral commissure passes off on the right of the figure, and the subcerebral commissure near the bottom. On the left the inner side of the enlarged anterior end of the penial retractor is seen in transverse section, with the terminal portion of the vas deferens embedded in its lower part.

PLATE XXXII.

Map illustrating the Geographical Distribution of the Genus *Onchidella*.

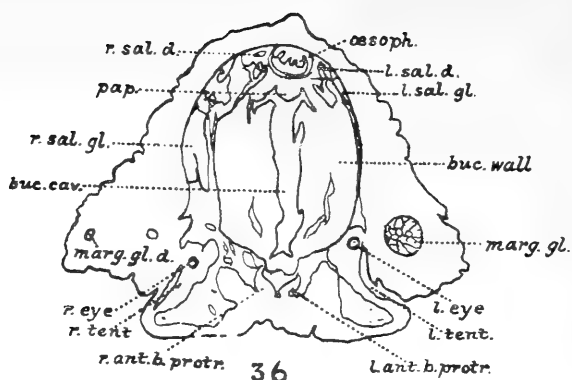




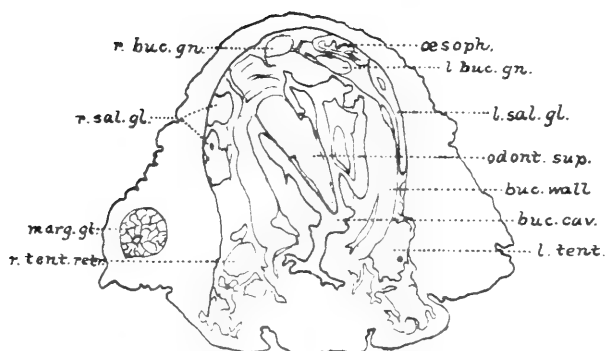


H. Watson, del.

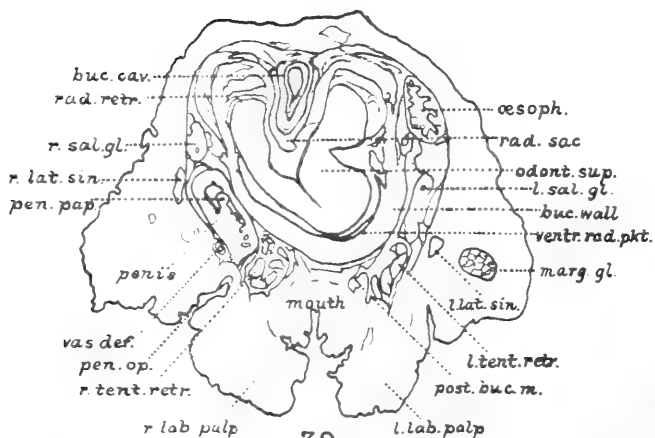
ONCHIDELLA



36



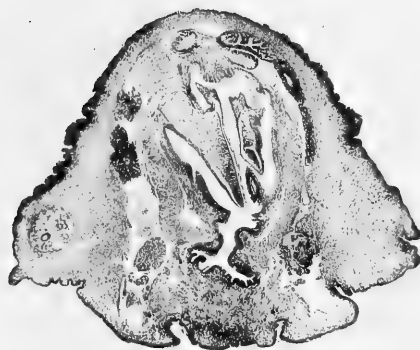
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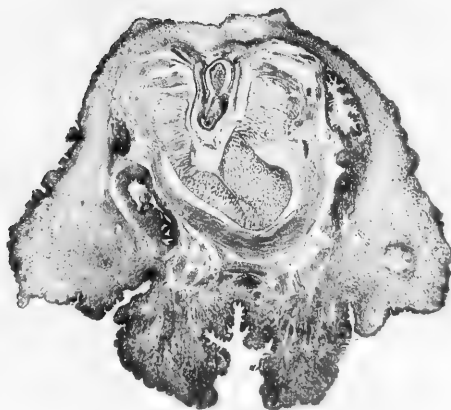
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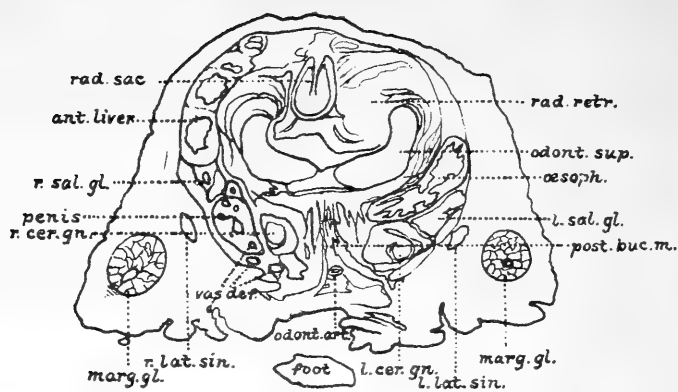
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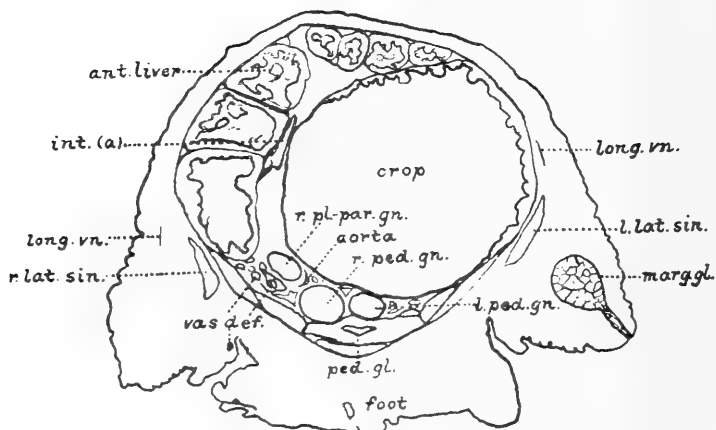
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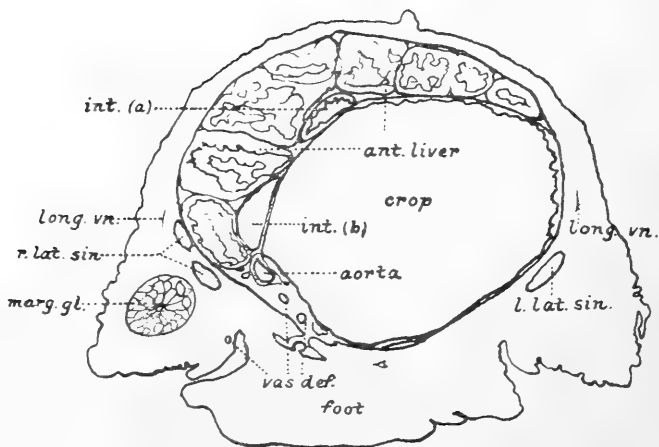
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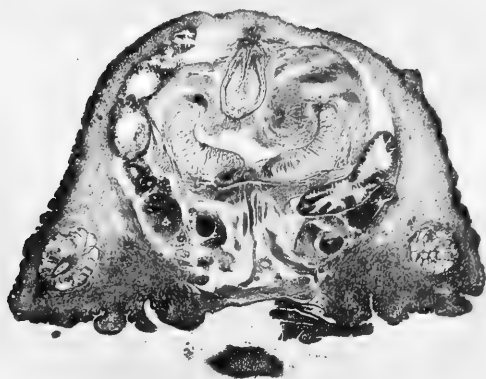
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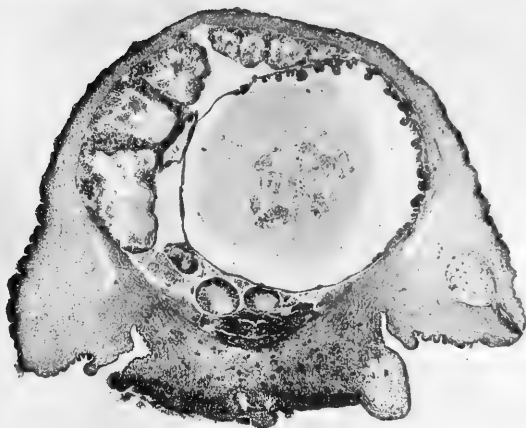
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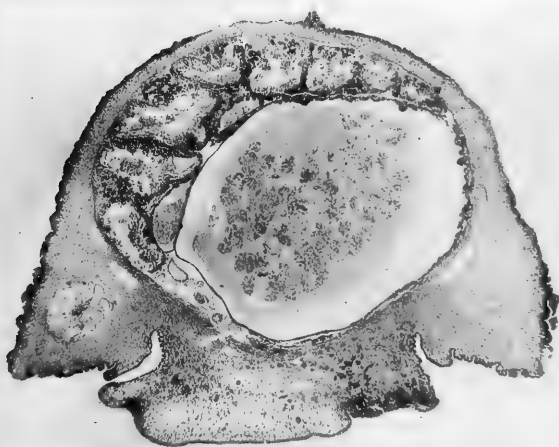
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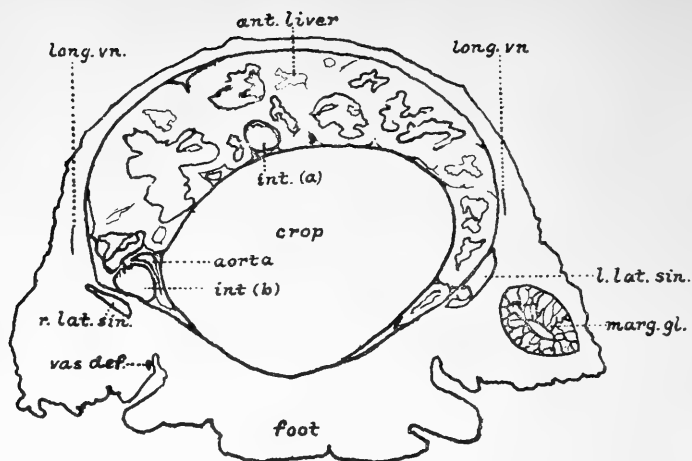
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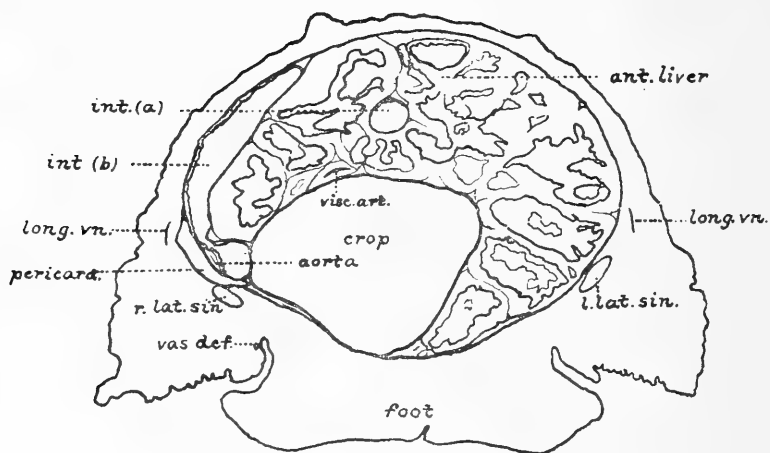
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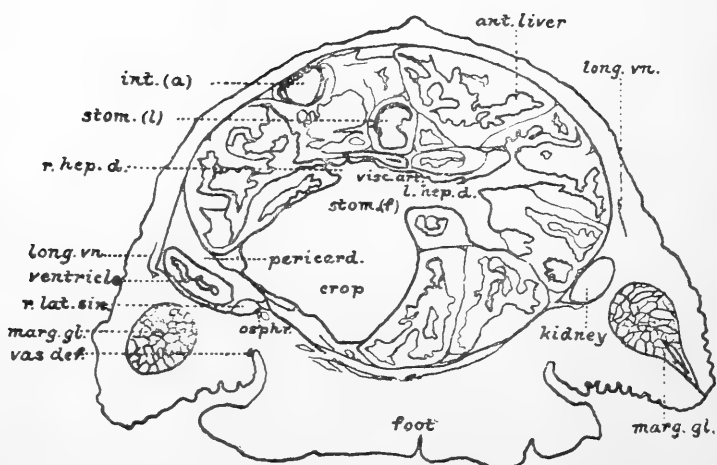
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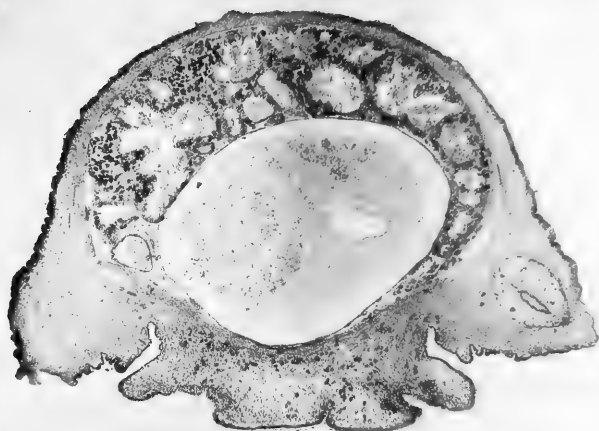
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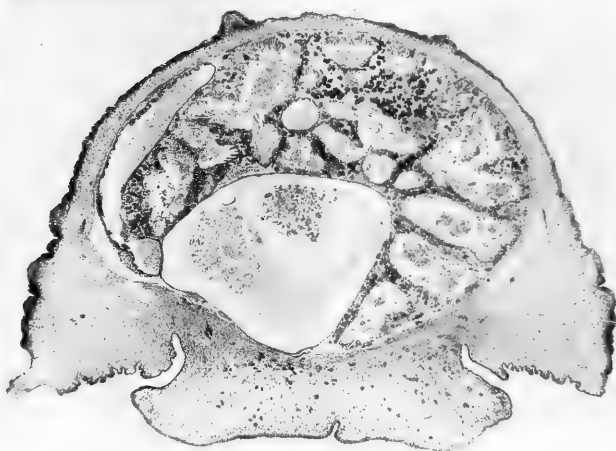
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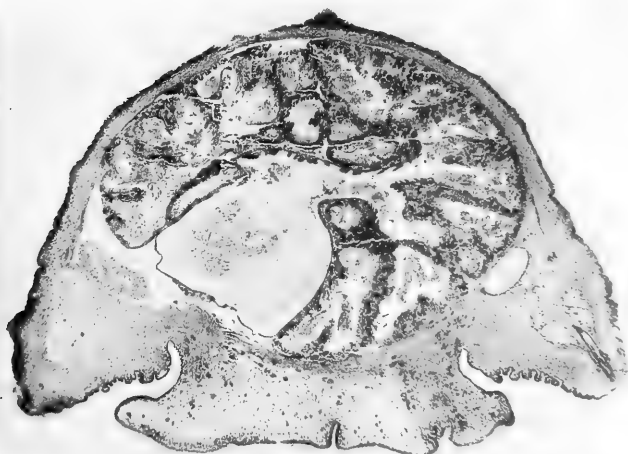
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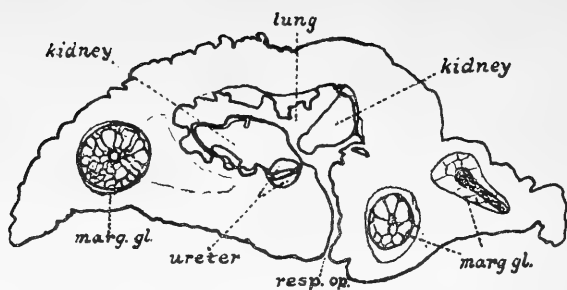
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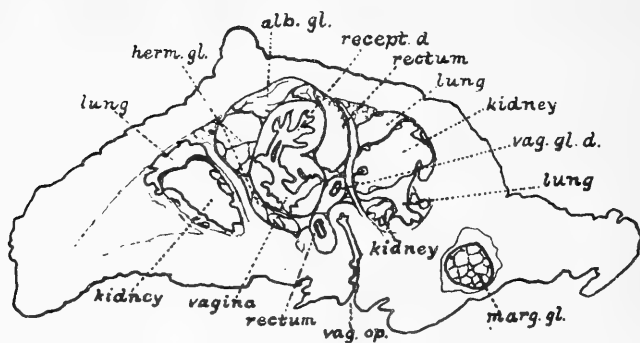
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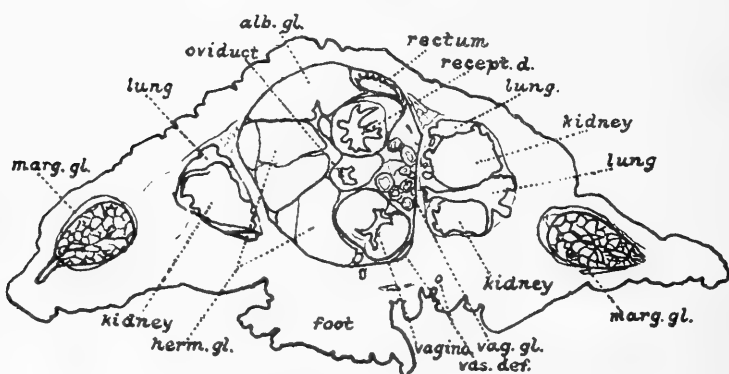
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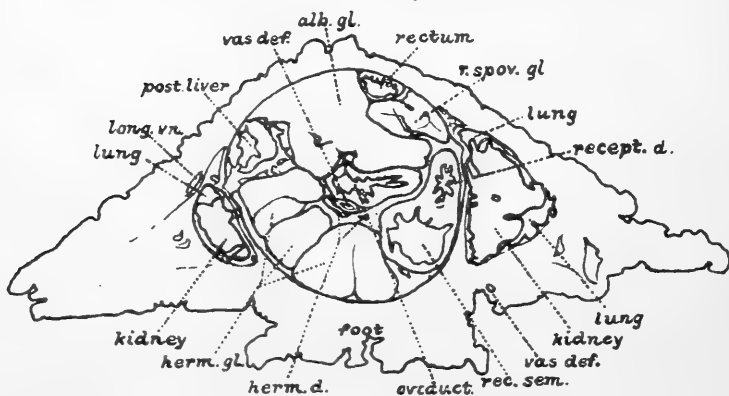
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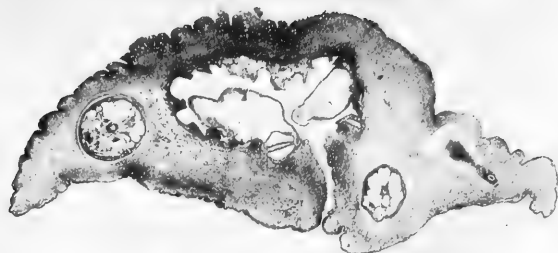
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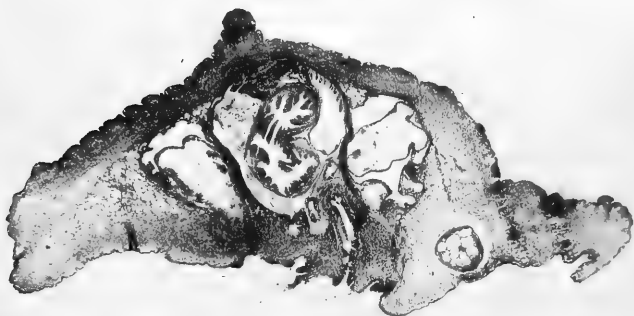
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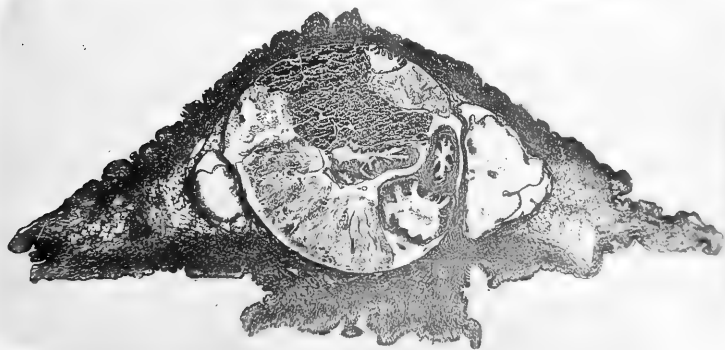
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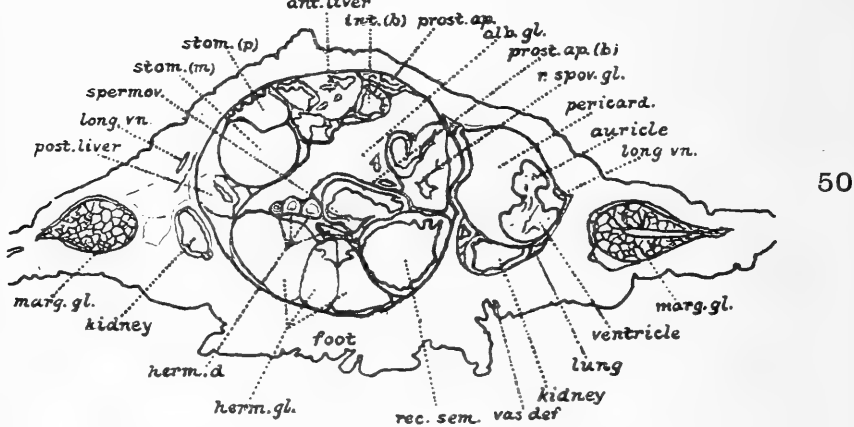
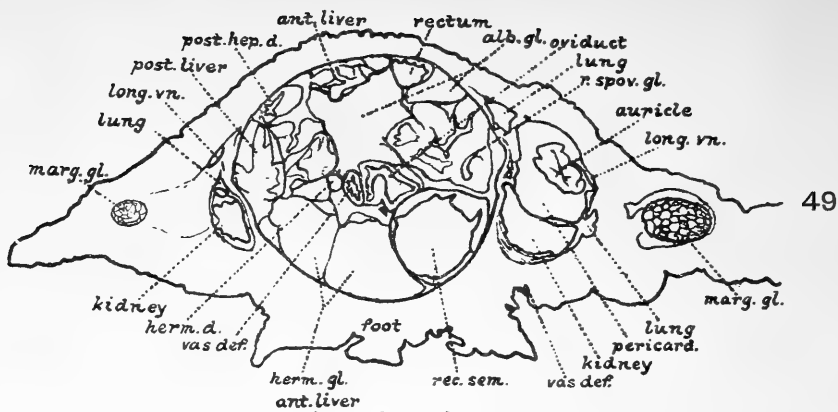
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H. Watson, photo.

ONCHIDELLA.





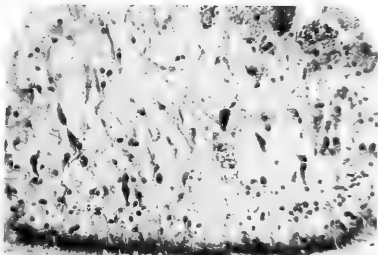
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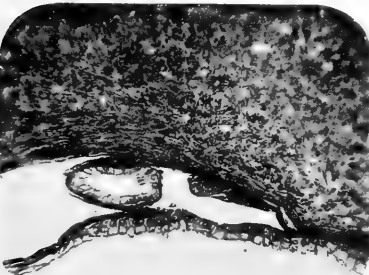
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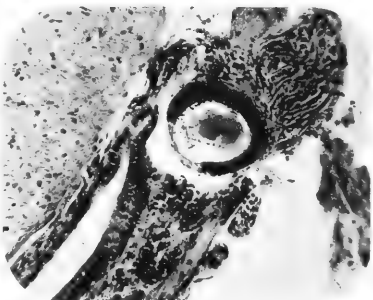
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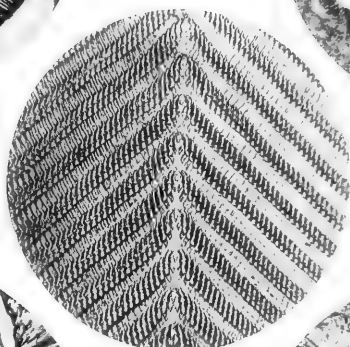
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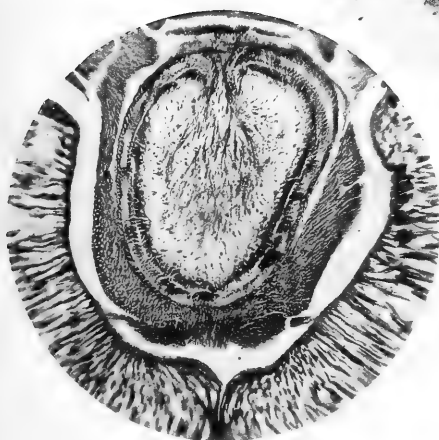
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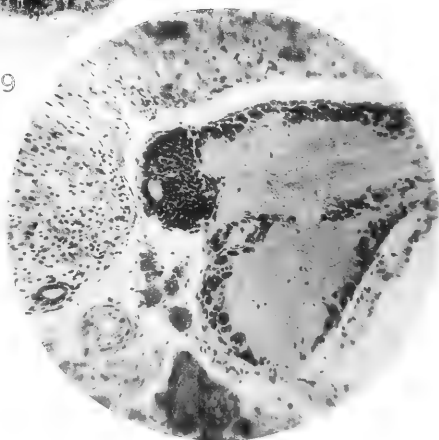
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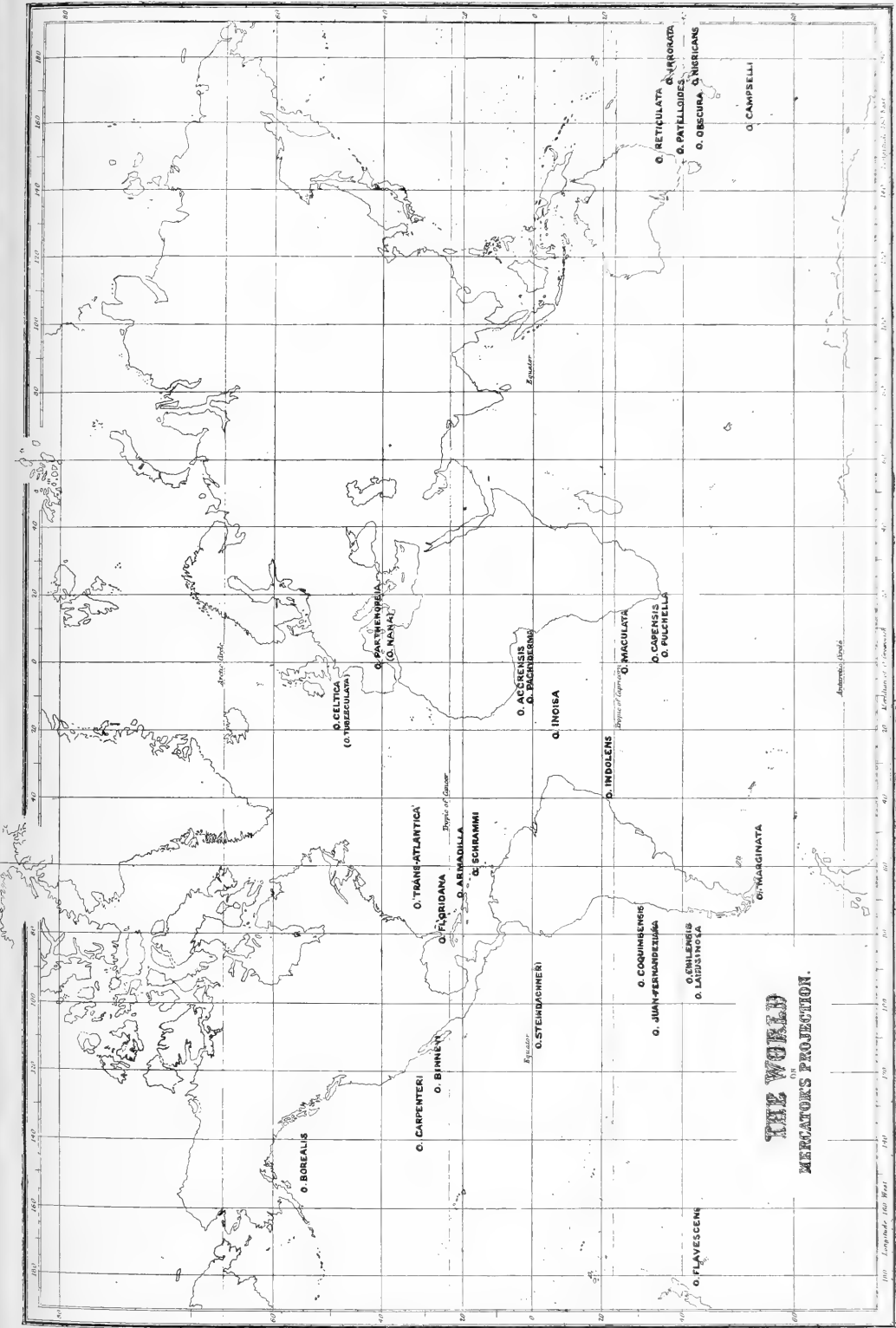
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H. Watson, photo.

ONCHIDELLA.



MAP ILLUSTRATING THE GEOGRAPHICAL DISTRIBUTION OF THE GENUS *ONCHIDELLA*.

7. *Reports on the Marine Mollusca in the Collections of the South African Museum.*—By J. R. LE B. TOMLIN, M.A.

I. FAMILY TURRITELLIDAE.

(With three Text-figures.)

THE series in this family that I have examined raise several interesting and important points, which are discussed under the various species. The discovery of the habitat of *T. ferruginea* Reeve. is particularly satisfactory.

The *Turritellidae* exhibit a certain amount of variability in the coiling of the shell, and this has even led to unnecessary specific segregation as in the case indicated below. This variability is only what one might be led to expect from a consideration of their affinity with the *Vermetidae*.

I venture to suggest that the term *scalarescence* might be conveniently employed to denote this tendency to looser coiling, so well exemplified in the form that has been differentiated as *T. excavata* Sow. J. T. Marshall remarks of the British species *T. communis* Risso that “the lower whorls are invariably more loosely coiled than the upper, with a deeper suture.”

Some species in the family seem to have habitually a broader and a slenderer form, as, for instance, *T. communis* Risso and its var. *gracilis* Jeff., and I am almost convinced that this dimorphism is likewise exemplified locally by *T. carinifera* Lam. and *T. kowiensis* Sow.

The types of the new species are in the South African Museum.

Turritella ferruginea Reeve.

Conch. Icon., v, pl. vii, fig. 32, May 1849.

The rediscovery of this fine species enables us to assign it for the first time to a definite locality. Reeve described it from the Cuming

collection, with locality unknown. It is now a fair inference that Cuming's specimens were dredged by the "Samarang" on the Agulhas Bank.

It is, of course, well known that until the voyage of the "Challenger" no lien was placed by government authorities on material collected by such expeditions: a report was usually published in due course and a certain number of new species described, but the actual material usually passed into the captain's hands, and was by him sold, given away, or retained at will. In the case of the "Samarang" the captain was Sir Edward Belcher, and the cream of the material eventually passed into the hands of Cuming and Lombe Taylor. Belcher was a rough, roistering, old-style sailor, who bothered very little about localities and relied mainly on his memory. I have handled a good deal of material ex coll. Belcher in the British Museum (Natural History) and can testify to the absence of any sort of data, and Dr. Dall of Washington tells me that he heard much the same account of Belcher from Carpenter, who knew him personally. The monotonous repetition of "China Sea" or "Eastern Seas" as a locality for new species in the Mollusca of the "Samarang" seems to tell a similar tale.

It may be wondered why such a splendid novelty was not described in the record of the voyage. It is now known that the Zoology of the "Samarang" appeared in parts, and that the approximate date of publication of part 7, which contained the genus *Turritella*, was August 1850, though the title-page of the Mollusca bears the date 1848. *Turritella ferruginea* had therefore been "out" for fifteen months, and would not be included in the "Samarang" volume, which only took cognisance of new species.

It may be interesting to note that the ship returned to England in December 1846, and the first reference in print to its Mollusca* occurs in April 1847.

Distribution.—*T. ferruginea* Rve. has been dredged from False Bay (juv.) to Algoa Bay, 30–54 fathoms; off Cape Point in 250 fathoms (South African Museum).

The freshest specimens are the young ones from False Bay and Agulhas Bank and an adult from Sebastian Bay: those from off Cape Point are dead and partly calcined.

The largest example, which has lost the uppermost 4 or 5 whorls, measures 97 mm. in length and 26 mm. in breadth at the base, and its aperture 13×18 mm.

* Reeve, Conch. Icon., iv, Chiton sp. 54.

Turritella sanguinea Reeve.

Conch. Icon., v, pl. vi, fig. 27, May 1849.

T. puncticulata Sowerby, P.Z.S., 1870, p. 253.

T. punctulata, D. (by error), Marine Shells S. Africa, p. 39, pl. v, fig. 102, 1892.

Reeve described this species from California, but no such shell is known from that region.

A comparison of the types, which came from the Belcher collection,

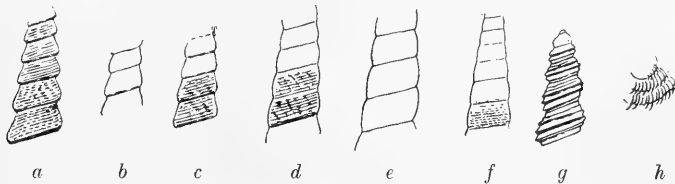


FIG. 1.—*T. sanguinea* Rve. a-f, half nat. size; g, juvenile, enlarged; h, portion of operculum, enlarged.

with Sowerby's type of *puncticulata*, shows that the two shells are identical, the former specimens being somewhat immature and slightly "doctored." Probably Sowerby was misled by the false locality of *sanguinea* into describing it over again. In 1889 he recorded* a "somewhat doubtful" specimen of *T. sanguinea* Rve. from South Africa.

This species is much subject to scalarescence, and two very different forms are figured by Martens† and Sowerby.‡ I am able to illustrate this variation by a series of admirable drawings by Dr. Barnard of the South African Museum.

The former author compares *puncticulata* with *sanguinea*, and concludes that they are nearly related but distinct, mainly owing to a difference in the number of spiral ribs. The comparison is, however, discounted by the fact that his only exponent of *sanguinea* was a specimen from the Paetel collection, which may possibly not have been *sanguinea* at all: moreover, both the character of the ribs and their number is variable even in examples dredged together; small accessory riblets keep on developing between the larger ones; these riblets increase in size on subsequent whorls and become large ribs, but even on the last whorl small riblets continue to make their appear-

* J. of C., vi, 152.

† Deutsch. Tief-See Exp., vii (1), pl. iv, fig. 9.

‡ Marine Shells S. Africa, pl. v, fig. 102.

ance. Martens also mentions one or two other differences which seem of trivial importance, e.g. a slightly slower increase in the breadth of the whorls.

Animal living in the last five whorls, which are shut off from the earlier ones by one or two partitions (Barnard).

The operculum has scarious edges to each whorl, with beaded riblets radiating from the nucleus and projecting as short hair-like processes from the scarious edges.

Dredged from False Bay and the Agulhas Bank eastwards to Cape St. Blaize, 18-45 fathoms (South African Museum): Algoa Bay (Tief-See Exp.). Live specimens were taken by the "Pieter Faure" off Cape Infanta and Struijs Point.

The largest specimen, which lacks about ten of the early whorls, is 100 mm. in length with a maximum diameter of 23 mm.

Turritella carinifera Lamareck.

Anim. sans Vert., vii, p. 59, August 1822.

Mossel Bay: off Cape Point, 130 fathoms; coast of Zululand 13 fathoms (South African Museum).

It is a shallow-water species, and the three from 130 fathoms had probably been washed down by currents. From a living example washed ashore in False Bay it was ascertained that the operculum has the margin of each whorl entire, not fimbriate, and has not the radiating riblets of *sanguinea*.

Turritella kowiensis Sowerby.

Proc. Malac. Soc., iv, p. 6, pl. 1, fig. 12, 2nd April 1900.

There is every probability that this will eventually prove to be a slender form of *carinifera* Lam. In addition to the consistently smaller diameter, the keel which runs round the middle of the whorls is but slight, whereas in *carinifera* it forms a very strong raised cord. Otherwise the sculpture in the two forms is identical. Up to the present no specimen has been found exceeding 23 mm. in length; adults are probably much larger, and their absence is probably due to the meagre amount of systematic dredging in suitable localities. Until the discovery of an adequate series of connecting links, it seems better to keep the two forms separate

Turritella natalensis Smith.

Ann. Natal Mus., ii (2), 198, pl. vii, fig. 11, 20th December 1910.

The type specimen of this in the British Museum is a much worn shell (Durban, Westcott) and lacks the apex, so that presumably Smith's description *primus anfractus laevis* was taken from the Isezela specimen. One of the present has the apex absolutely perfect, and it appears under a 1-in. power to be bulbous, glassy white, smooth, but not polished: the next whorl has a single, central, obsolete keel, and the whorl after that has three. The protoconch seems to consist of four whorls, the fourth having three strong spirals and several subsidiary ones. On the basal whorls the general sculpture scheme consists of five or six stronger spirals with two or three finer threads between, and extremely fine oblique axial lines which very quickly disappear by abrasion.

The coloration consists of very irregular zigzag axial streaks of reddish-brown on a white ground. The dotted effect of which Smith speaks is mainly due to beach-rolling.

These specimens, which look as if they may have been taken alive, were dredged off the Umvoti River, Natal, in 27 fathoms. None of them is quite as large as the type.

Turritella declivis A. Adams and Reeve.

Zool. Samarang, Moll., p. 48, pl. xii, fig. 10, 1850.

T. excavata Sowerby, P.Z.S., 1870, p. 252.

On the series now before me I have no hesitation in uniting the above two species. It is certainly a case of normal and scalarescent forms, and I am able to illustrate the transition with another admirable series of drawings by Dr. Barnard.

The typical form has absolutely flat whorls increasing with complete regularity, each whorl being flush with the preceding one and the suture merely an impressed line.

In the scalarescent form each whorl swells out considerably above the suture and projects noticeably beyond the upper half of the succeeding whorl, the suture itself forming quite a deep channel. The whole shell is broader throughout.

The original description of *declivis* appears in the "Samarang" report, and the locality "China Sea" must be rejected as erroneous. The types of *declivis* and *excavata* are now in the British Museum,

both acquired from the Lombe Taylor collection in 1874. It may be safely surmised that L. Taylor had them from Belcher, and that the locality "China Sea" was a product of his not very fertile memory. The type of *excavata* is labelled "Agulhas Bank."

Distribution.—False Bay and Agulhas Bank to East London in from 30 to 124 fathoms, but hitherto not taken alive. There is a

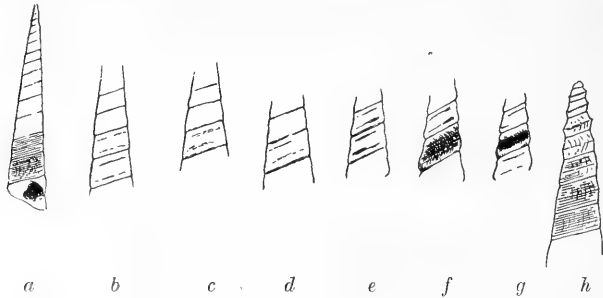


FIG. 2.—*T. declivis* A. Ad. & Rve. + *excavata* Sow. series. *a-g*, half natural size; *h*, juvenile, enlarged.

single specimen in the Cape Town Museum which is said to have been picked up in Hout Bay, on the west shore of the Cape Peninsula (South African Museum).

The largest measures 89 mm. in length, with a basal diameter of 16 mm.: the Hout Bay shell measures 70×17 . Of the *excavata* form there is a specimen 69×19 , and the "Valdivia" dredged one 85×21 . All these have lost some of the apical whorls. In some young shells from 49 fathoms off Great Fish Point the protoconch is nearly perfect, but much eroded; the whorls of the protoconch have a strong central carina throughout, and there are traces of spiral striations between the carina and the sutures.

Turritella salisburyi, n. sp.

Shell elongate, rather thin; remaining whorls twelve (the apex being broken off in both examples), increasing rather rapidly; the colour of the first six or seven whorls is whitish to yellowish, but gradually changes to a pinkish hue, which deepens to a dark flesh colour on the last two or three; below the suture on the last six whorls is a regular series of alternate white and dark spots. The sculpture consists of rather fine, regular, spiral lirae, the spaces between the lirae being almost flat and varying considerably in breadth; in the type specimen there are twenty-four of these lirae on the penultimate, and the

same number on the antepenultimate whorl; on the first five whorls there is a tendency for the alternate interspaces to be considerably raised and to form strong cords. The sutures are rather shallow,

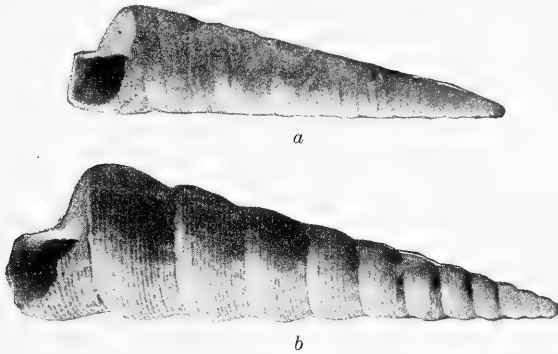


FIG. 3.—*a*, *Turritella chrysotoxa*, n. sp. $\times 3\frac{3}{5}$; *b*, *Turritella salisburyi*, n. sp. $\times 2\frac{1}{4}$.

though the lower half of each whorl is distinctly tumid; periphery rounded, very slightly angular; aperture rotundate.

Length, 34 mm.: max. diam., 10 mm.

Hab., off East London in 30–50 fathoms, two specimens (South African Museum); Port Alfred on the beach (Turton).

In general appearance this new species is much like a miniature *T. sanguinea* Rve., and in the type the interspaces are regularly spotted with darker colour as in that species. They differ, however, radically in sculpture; this is unusually regular for a *Turritella*, and the equality in the size of the spirals on the later whorls is particularly noticeable.

Turritella chrysotoxa, n. sp.

This is a small glossy species, of a rather light yellow-brown colour, marked on the last five or six whorls with very numerous arcuate growth-lines. There are fourteen whorls remaining—the first is glassy white (all that is left of the protoconch); the next three are encircled with a strong keel on the lower third of the whorl; each of the others has three conspicuous raised lines which are equidistant from one another and from the sutures; in the spaces between these lines two or three weak spirals occur on the last few whorls. Sutures very slightly impressed, the whorls being much flattened.

Periphery bluntly right-angled with a raised line immediately above it in addition to the three already described.

Aperture almost square.

Length, 16 mm. : max. diam., 4 mm.

Hab., off the Illovo River, Natal, in 27 fathoms, two specimens (South African Museum).

The shells may not be quite adult, but are abundantly distinct from any other South African form.

The specific name is derived from *τόξον*, a bow, in allusion to the fine bow-shaped lines of growth.

ANNALS

OF THE

SOUTH AFRICAN MUSEUM

VOLUME XX.

PART V, containing:—

8. *A New Clypeaster from Angola.* By HUBERT LYMAN CLARK, Museum of Comparative Zoology, Cambridge, U.S.A. (With Plate XXXIII.)
9. *Contributions to the Crustacean Fauna of South Africa.* By K. H. BARNARD, M.A., D.Sc., F.L.S., Assistant Director. (With Plate XXXIV.)
10. *Contributions to the Crustacean Fauna of South Africa.* By K. H. BARNARD, M.A., D.Sc., F.L.S., Assistant Director. (With 6 Text-figures.)



ISSUED DECEMBER 1925. PRICE 4s.

PRINTED FOR THE
TRUSTEES OF THE SOUTH AFRICAN MUSEUM

BY NEILL AND CO., LTD.,

212 CAUSEWAYSIDE, EDINBURGH.



8. *A New Clypeaster from Angola*.—By HUBERT LYMAN CLARK,
Museum of Comparative Zoölogy, Cambridge, U.S.A.

(With Plate XXXIII.)

THROUGH the kindness of the Director of the South African Museum, the bare and somewhat waterworn test of a Clypeaster from the coast of Angola was sent to me for identification. As it proves to be quite distinct from any recent species hitherto described, and cannot be referred to any fossil species known to me, I venture to describe it as a new species, which may be called, because of the relatively small petaloid area,

Clypeaster micropetalus.*

Length 121 mm. ; greatest width (across petals II and IV), 104 mm. ; greatest height (in interporiferous area of petal III), 31 mm. ; height at madreporite, less than 30 mm. ; thickness of test margin about 13 mm. Test stout, somewhat flattened at apex, but sloping upwards rather uniformly from the thick margin. Interporiferous areas conspicuously swollen, except basally, where the petals are quite flat. Petaloid area relatively small, only 70 mm. long by 64 mm. wide ; petal III, distinctly longest, 40 mm. long, by 21 mm. wide, widest at middle, with interporiferous area 14 mm. wide at that point, and poriferous areas widest near tip, where each is about 5 mm. across ; there are about 46 pore-pairs on each side of the petal, and the ridges between the pore-pairs, distally, carry 6-8 primary tubercles. Other petals quite similar, I and V about 36 mm. long and II and IV about 34 mm. All the petals tend to be closed, but petal III is open by 3.5 mm., petals I and V by 2.5 mm., and II and IV by less than 2 mm. ; in all, the interporiferous area is distinctly attenuate distally. Tuberculation of test rather fine, about 125 primary tubercles to a square centimetre of the aboral surface ; orally the primary tubercles are larger, but are closer together near test margin and much more widely separated near mouth ; in inter-

* Μικρός=small+πέταλον=a petal.

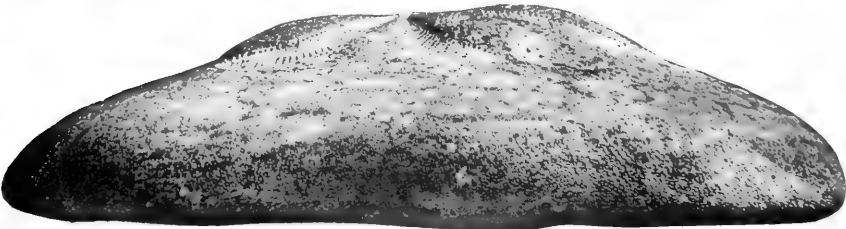
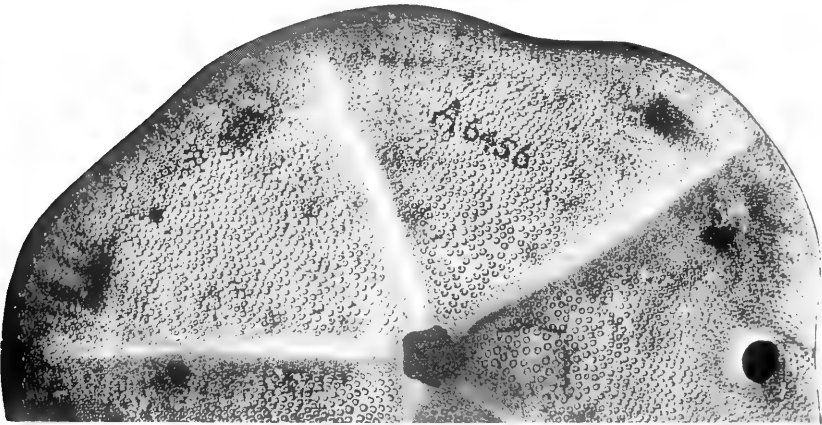
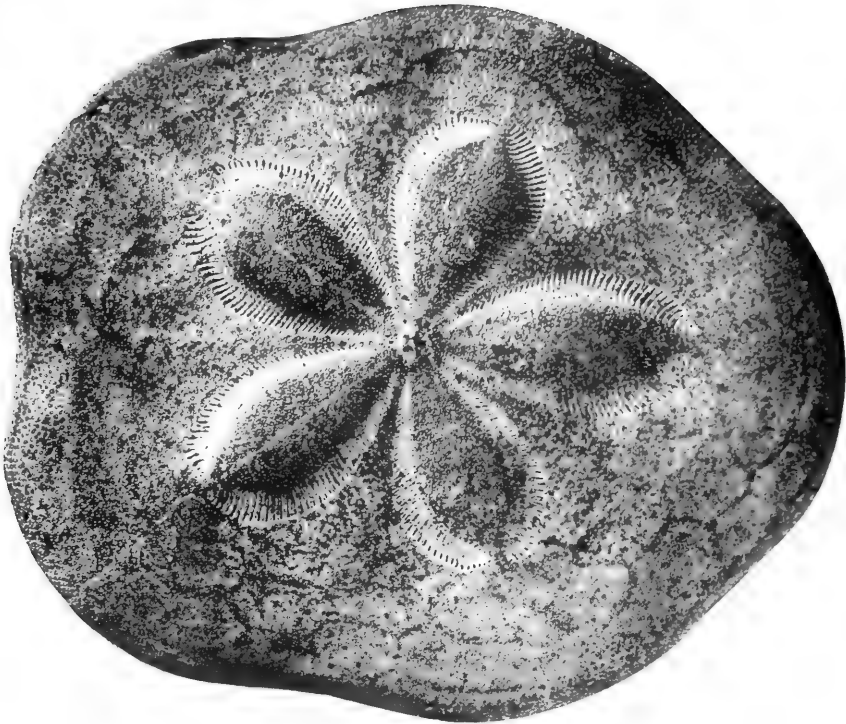
ambulacrum 5 just distal to mouth there are only about 35 primary tubercles in a square centimetre.

Oral surface flat near margin, but becoming rather suddenly deeply sunken at mouth, which is 11 mm. below the margin (when test is inverted). Ambulacral furrows conspicuous and considerably sunken. Periproct 6.5 mm. wide, 5.5 mm. long; its posterior margin is 6 mm. from the edge of the test, so it is distinctly actinal and not submarginal in position.

Colour, dirty white orally, but becoming gray aborally, especially on interporiferous areas.

Elephant Bay, Angola, about 60 miles south of Benguela. One specimen. South African Museum, No. A 6456.

This well-marked species finds its nearest ally in *C. japonicus* of Japan, and in *ochrus* and *speciosus* of the west coast of Central America. It is easily distinguished from these species, however, by the small size of the petaloid area, the shape of the petals, particularly the attenuate interporiferous area, the finer tuberculation, and the distinctly actinal periproct. It is totally unlike the South African species, *audouini* and *eurychorius*. As Elephant Bay is north of Mossamedes, this new Clypeaster cannot be counted in the South African fauna, as defined in my "Echinoderm Fauna of South Africa" (1923, Ann. S. Afr. Mus., vol. xiii, p. 222), but it is not unlikely that it will ultimately be found at least on the northern part of the coast of South-West Africa.



CLYPEASTER MICROPETALUS n.sp.

9. *Contributions to the Crustacean Fauna of South Africa*.—By K. H. BARNARD, M.A., D.Sc., F.L.S., Assistant Director.

No. 8. FURTHER ADDITIONS TO THE LIST OF AMPHIPODA.

(With Plate XXXIV.)

THE final report on the Amphipods collected by the Cape Government trawler S.S. "Pieter Faure" during the years 1897–1907 is presented in the following pages.

This last portion of the collection has proved extremely interesting, as it contained a number of species from deep water off Cape Point, some of which were already known from the North Atlantic, while others appear new to science.

With regard to the depths at which the specimens are stated to have been captured, it must be borne in mind that the "Pieter Faure" used no closing nets, so that while in the case of a particular species the correctness of the data may be gauged by analogy with records of the same species or other species of the same family in other parts of the world, the data cannot be used in a critical case to determine whether a species (*e.g.* one of the *Phronimidea*) is benthic or pelagic.

A small number of littoral species have been included which have come to hand since the publication of my last paper.

Altogether 36 species and 1 variety are added to the local fauna list, bringing the total number up to about 207. Further collecting, both in littoral and deeper waters, will certainly bring still more additions.

References to the literature on the families have not been included, as they are to be found in Stebbing's General Catalogue, 1910, or my 1916 paper, except where the family has not previously been recorded from South Africa, or where an important paper has appeared since 1916.

The types of all new species are in the South African Museum.

My thanks are again due to my friend Mr. F. W. Edwards, of the British Museum, for tracings of figures; to Mr. H. C. Burnup of

Maritzburg, who submitted for identification a series of Natal Amphipods collected by him while pursuing his special favourites—the Mollusca; and to Mr. H. W. Bell-Marley, who has also sent many interesting specimens for identification.

TRIBE GAMMARIDEA.

FAMILY LYSIANNASIDAE.

Gen. TRISCHIZOSTOMA Boeck.

1861. *Trischizostoma*. Boeck, Forh. Skand. Naturf. Möde, 8, p. 637.
 1916. „ Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3,
 p. 106 (references).

Trischizostoma paucispinosum Brnrd.

1916. *Trischizostoma paucispinosum*. Barnard, *loc. cit.*, p. 107,
 pl. xxvi, fig. 1.

Two further specimens of this species were found in a sponge (Cape Point, N.E. $\frac{1}{4}$ N., distant 18 miles, 135 fathoms. S.S. “Pieter Faure,” 27/2/02. S.A.M., No. A 4530). Both apparently are males, measuring 15 mm. The agreement with the original description is maintained. In the comparison with *T. remipes*, however, there was a rather ambiguous statement, namely, that none of the joints of the peraeopods except the 2nd joints in the 3rd–5th peraeopods were expanded. By this it might be understood that the 3rd–5th peraeopods resembled those of *raschi* and *nicaeense*. Such is not the case; the 5th peraeopod is of the same type as in *remipes*, but the 5th and 6th joints are not so strongly expanded. Comparison of further examples has shown that the two species cannot be distinguished on this character alone.

The only reliable characters for distinguishing this species from *remipes* are the palmar armature of the 1st gnathopod, feeble in the former, well developed in the latter species; and the side-plates, which are much deeper in proportion to their segments in *paucispinosum* than in *remipes*.

Trischizostoma serratum n. sp.

(Plate XXXIV, fig. 1.)

Five specimens seem to deserve a separate name on account of the character of the 1st gnathopod, although in other respects they are closely allied to *remipes*.

Eyes reniform, slightly widened above, nearly meeting on the top of the head. Rostrum short, deflexed. Side-plates and other characters, except the 1st gnathopod, as in *remipes*.

First gnathopod, 6th joint transversely oval, palm straight or concave, defining angle rather strongly produced to a blunt point, with 1-2 stout blunt spines and 1 long falciform spine; palm quite entire, armed with 7 stout marginal and 5 stout submarginal spines; finger strongly arcuate distally, closing over the long spine, but within the actual apex of the produced defining angle, inner margin with a series of about 16 conical denticles at regular distances apart.

The structure of this gnathopod is very striking and quite distinct from those of the other species. The typical development is found in the 3 specimens (A 4531), measuring 8, 6, and 4 mm. respectively. But in specimen A 4532, 8 mm. in length, the defining angle is quadrate, only very slightly produced, and the long spine is straight and apically acute; the palmar spines also are more slender and acute; the finger is denticulate, but not so strongly.

Further, in specimen A 4533, 7 mm. in length, the palmar spines are even more slender and the finger is very obscurely denticulate, the whole hand and finger bearing a strong likeness to that of *paucispinosum*. In other respects both these latter specimens agree with the three typical ones.

None of the specimens seem to be sexually mature. No transitional forms were found amongst the examples of *remipes* in the collection.

Length.—Up to 8 mm.

Colour.—In spirit, yellowish, eyes dark red.

Locality.—Umhloti River, N. by W. $\frac{1}{2}$ W., distant 8 miles, 40 fathoms, 3 specimens; Itongazi River, N.W. $\frac{3}{4}$ W., distant 3 miles, 25 fathoms, 1 specimen; Port Shepstone, N., distant 8 miles, 36 fathoms, 1 specimen. All localities on Natal coast. S.S. "Pieter Faure," 18/12/00, 14/3/01, and 14/3/01. (S.A.M., Nos. A 4531-3.)

Trischizostoma remipes Stebb.

1908. *Trischizostoma remipes*. Stebbing, S.A. Crust., pt. 4, p. 61, pl. xxxiv.

1910. „ „ *Ibid.*, Gen. Cat. S.A. Crust., p. 448.

Between 50 and 60 specimens, excluding juveniles taken from the brood-pouch, have been examined.

The characters enumerated by Stebbing are constant, except that

the 6th joint of 5th peraeopod is not always longer than the 5th joint, though it is never shorter.

The eyes in juveniles from the brood-pouch and quite young specimens are oval or reniform. The approximation of the two eyes on the top of the head does not seem to follow *pari passu* with growth, nor can it be correlated with sex. In some specimens the eyes actually meet and coalesce in the middle dorsal line, but these are not the largest specimens.

The minute serrulation of the palm of the 6th joint of the 1st gnathopod is very characteristic, and never absent except in the juveniles taken from the brood-pouch. In these the palm is quite smooth, with only a single spinule at the defining angle, as figured by Sexton (Proc. Zool. Soc. Lond., 1908, pt. 2, pl. xix, fig. 10) for *T. raschi*.

Length.—Up to 20 mm.

Colour.—In spirit, yellowish or pinkish, eyes dark red.

Locality.—Several localities from Cape Point to Cape Morgan, 23–154 fathoms.

Most of the specimens were loose in bottles containing various organisms, but in one case numerous specimens, ♂♂ and ovigerous ♀♀, were found in galleries in a sponge. These galleries had the appearance of having been excavated by the Amphipods.

The northern species are usually found on fishes or star-fish, but also free-swimming (Sexton, *loc. cit.*, p. 396).

Gen. ACIDOSTOMA Lillj.

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| 1865. | <i>Acidostoma</i> . | Lilljeborg, N. Acta. Soc. Upsala, ser. 3, vol. vi,
No. 1, pp. 18, 34. |
| 1890. | „ | G. O. Sars, Crust. Norw., vol. i, p. 37. |
| 1906. | „ | Stebbing, Das Tierreich, 21, p. 14. |

Acidostoma obesum (Bate).

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| 1862. | <i>Anonyx obesus</i> . | Bate, Cat. Amph. Brit. Mus., p. 74, pl. xii,
fig. 1. |
| 1865. | <i>Acidostoma obesum</i> . | Lilljeborg, <i>loc. cit.</i> , p. 34, pl. v. |
| 1890. | „ | Sars, <i>loc. cit.</i> , p. 38, pl. xiv, fig. 2. |
| 1906. | „ | Stebbing, <i>loc. cit.</i> , p. 14. |

Agreeing entirely with Sars' description and figures except in two details. The flagellum and accessory flagellum of the 1st antenna are respectively 5- and 4-jointed instead of 7- and 5-jointed. There

is absolutely no trace of the rudimentary palp on the outer margin of the outer plate of the 1st maxilla.

Length.—5 mm.

Colour.—In spirit, pale pinkish, with numerous darker specks, as shown in Sars' figure, eyes pinkish.

Locality.—Duminy Point (off Saldanha Bay), E. by N. $\frac{1}{2}$ N., distant 8 miles, 87 fathoms, 2 specimens. S.S. "Pieter Faure," 17/3/02. (S.A.M., No. A 6050.)

Geogr. Distribution.—North Atlantic, West coast of Europe.

PHOXOSTOMA n.g.

Close to *Acidostoma*, but with well-developed 2-jointed palp on the 1st maxilla; inner plate of maxilliped elongate, gnathopod 2 minutely chelate, uropod 3 not very small and telson cleft.

Phoxostoma algoense n. sp.

(Plate XXXIV, fig. 2.)

♀. Body moderately robust. Eyes large, reniform, meeting on the top of the head. Antero-lateral angles of head subacute. Peraeon and pleon dorsally and subdorsally with scattered setules. Side-plates deep, 1 concealing base of 2nd antenna, widened below, 2 not concealing lower front corner of 1, 2 and 3 scarcely widened below, 4 deeper than its greatest length, lower margin quite even from lower front angle to hinder angle, which is subacute, hind margin deeply excavate. Postero-inferior angle of pleon segment 1 rounded, of segment 2 quadrate with sharp apex, of segment 3 also quadrate, but with the actual apex rounded off. None of the pleon segments dorsally carinate or impressed.

Telson a little longer than broad, narrowing distally, the lateral margins straight or slightly convex, cleft or deeply insinuate nearly to the centre, apices rounded with a setule on each.

First antenna, 2nd joint nearly half length of 1st, 3rd half 2nd, flagellum not equal to 1st peduncular joint, 7-jointed, accessory flagellum shorter than flagellum, 4-jointed.

Second antenna slender, not longer than 1st, ultimate peduncular joint longer than penultimate, flagellum 8-jointed.

Mouth-parts styliform, projecting below the anterior side-plates.

Epistome and upper lip continuous, very narrow, boat-shaped, the keel in profile appearing evenly convex, as in *Acidostoma*.

Lower lip, lobes narrow, lanceolate, apically acute.

Mandible slender, cutting-edge feeble, molar obsolete, palp attached far back, 2nd joint much the longest, 3rd longer than 1st, somewhat falcate, 2nd and 3rd with apical setae only.

First maxilla, outer plate narrow, tapering, apex with 6 denticulate spines and several setules, inner plate narrow, apex with 7 long setae, longer than the plate itself, palp slender, apex narrowed subacutely, extending to apex of outer plate, with a few minute setules, 2-jointed.

Second maxilla, both lobes narrow, lanceolate, apex of outer plate setulose on outer margin, on inner margin with a row of rather stouter setae regularly and closely set, inner plate apically unarmed.

Maxilliped, inner plate narrow elongate, extending almost to apex of outer plate, distally setulose, apex truncate, outer plate broad, inner apex rectangular, margin perfectly entire, palp extending very little beyond outer plate, 4th joint rudimentary, stout, unguiform, apex minutely bifid.

First gnathopod simple, 6th joint longer than 5th, tapering evenly, lower margin spinulose.

Second gnathopod minutely chelate, 5th joint longer than 6th, 6th oblong, lower apex shortly produced, 7th minute, unguiform, 6th densely setose (*cf.* Sars' figure of *Ambasia danielssenii* Boeck, Crust. Norw., vol. i, pl. xvii, fig. 1).

First and second peraeopods moderately stout.

Third to fifth peraeopods, 2nd joint broadly expanded, hind margin with scarcely visible serrulations, distal joints moderately stout.

Uropod 3 well developed, biramous. All the uropods feebly armed with spinules.

Length.—9 mm.

Colour.—In spirit, pinkish, eyes dark red.

Locality.—Algoa Bay, 36 fathoms. 1 ovigerous ♀. S.S. "Pieter Faure," 25/9/01. (S.A.M., No. A 4541.)

Gen. AMARYLLIS Hasw.

1880. *Amaryllis*. Haswell, Tr. Linn. Soc. N.S.W., vol. iv, p. 253.

1916. „, Barnard, Ann. S.A. Mus., vol. xv, pt. 3, p. 114 (references).

Amaryllis conocephalus n. sp.

Extremely close to *A. rostrata* Chevreux (1911, Bull. Inst. oc. Monaco, No. 204, p. 1, fig. 1) from the N. Atlantic, but clearly distinguished by the following features :

Head much more conical and produced, equal to the first 3 segments together, antero-lateral angles bevelled off. Side-plate 4 distinctly longer than deep, as in *A. bathycephalus* Stebb. Antenna 1 only twice the length of the head, 3rd peduncular joint a little more than $\frac{1}{3}$ 2nd, flagellum 7-jointed, 1st joint nearly as long as 3rd peduncular joint, nonsetose. Antenna 2 subequal to 1st, ultimate peduncular joint $\frac{1}{2}$ penultimate, flagellum 8-jointed. No calceoli on either flagellum. Palp of maxilliped more robust than in Chevreux's figure. Uropod 3, outer ramus a little longer than inner, no plumose setae.

Other characters as in *rostrata*.

The differences in the antennae and uropod 3 might well be due to sex, similar differences being found in *A. tenuipes* (Walker), 1904, and in *A. macrophthalma* Hasw., according to Stebbing and Barnard (*loc. cit.*). Chevreux's specimen of *rostrata* was a male; the present specimen is probably a female, but is nonovigerous. But the two first-mentioned characters are not so easily attributed to sex, and, until further specimens are discovered, may well constitute a separate species.

Length.—4.5 mm.

Colour.—In spirit, whitish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 1 specimen. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4546.)

Gen. CHEIRIMEDON Stebb.

- 1888. *Cheirimedon*. Stebbing, Challeng. Rep., vol. xxix, p. 638.
- 1890. ,, G. O. Sars, Crust. Norw., vol. i, p. 34.
- 1893. ,, Della Valle, F. u. Fl. Neapel, vol. xx, p. 837.
- 1903. ,, Walker, J. Linn. Soc. Lond., vol. xxix, p. 41.
- 1906. ,, Stebbing, Das Tierreich, 21, pp. 66, 720.
- 1912. ,, Chilton, Tr. Roy. Soc. Edin., vol. xlviii,
pt. 2, p. 467.

Cheirimedon pectinipalma n. sp.

♂. Antero-lateral corners of head subacute. Eyes indistinguishable. Side-plate 1 narrowed below to a subacute point, 2 not widened below, concealing the greater part of 1. Postero-inferior angle of pleon segment 3 slightly produced but rounded. Keel on pleon segment 4 not prominent.

Telson a little longer than broad, with a narrow cleft $\frac{1}{3}$ of length, apices rounded, with 1 spinule on each.

First antenna, 2nd and 3rd joints very short, flagellum 2-jointed, 1st long, densely setose, accessory flagellum 4-jointed, 1st nearly as long as 1st joint of flagellum.

Second antenna elongate, upper margin of peduncle with numerous little tufts of setules, flagellum ca. 33-jointed.

Upper and lower lips normal.

Mandible, molar rather more acuminate than in Sars' figure of that of *C. latimanus*.

First maxilla, outer plate with 8 denticulate spines, inner plate with 2 very stout, plumose setae, palp with 4 stout denticles at one end, and 1 spinule at the other end of the straight distal margin.

Second maxilla, both plates considerably stouter than in Stebbing's figure of *C. crenatipalmatus*.

Maxilliped, especially the margin of the outer plate, as figured for *latimanus*.

First gnathopod, 5th joint proportionately larger than in the other species, the inferior apex broadly rounded, 6th twice as long as broad, slightly widening distally, inferior margin slightly concave, palm transverse, minutely pectinate, a spine at the defining angle, finger matching palm, its inner margin with 4 minute spinules.

Second gnathopod as in *latimanus*.

First and second peraeopods rather slender.

Third to fifth peraeopods, 2nd joint expanded, hind margin entire, distal joints slender.

Uropods 1 and 2, rami subequal. Uropod 3, outer ramus 2-jointed, slightly longer than inner ramus.

Length.—7.5 mm.

Colour.—In spirit, pinkish.

Locality.—Cape Point, N.E. $\frac{1}{4}$ N., distant 46 miles, 760 fathoms, 1 ♂. S.S. "Pieter Faure," 27/9/03. (S.A.M., No. A 4542.)

This species is distinguished from the other species by the shape of the 5th and 6th joints of the 1st gnathopod, and the elongate 2nd antenna. The mouth-parts, except for one or two noteworthy details, agree with those figured for *crenatipalmatus* and *latimanus* by Stebbing and Sars respectively.

The 6th joint of the 1st gnathopod is very like that of *C. dentimanus* (Chevreux, Exp. Ant. Franc., p. 6, fig. 3, C, 1907), which species, according to Chilton (1912), is synonymous with *femoratus* Pfeffer. The 5th joint, however, is distinctive.

Gen. LAKOTA Holmes.

1908. *Lakota*. Holmes, Pr. U.S. Nat. Mus., vol. xxxv [1909], p. 498.

The two following species are assigned to this genus, in preference to *Chironesimus* Sars, on account of the narrow 6th joint of the 2nd gnathopod. This character and the relative widths of the 5th and 6th joints of the 1st gnathopod constitute the only differences between the two genera, and it must be confessed that the need for Holmes' genus is extremely doubtful. Moreover, Pearse (Pr. U.S. Nat. Mus., vol. xlv, 1913, p. 572) has described a species of *Chironesimus* differing from the type species in exactly those characters on which Holmes relied in instituting *Lakota*.

Therefore *C. multiarticulatus* Pearse must at least be transferred to *Lakota*, even if the latter genus be not sunk in *Chironesimus*.

Lakota adversicola n. sp.

Body rather compressed. Lateral lobes of head not much produced, subacute. Eyes apparently large and elongate, but very faint. Side-plate 1 narrowed below, 4 considerably expanded below, strongly emarginate behind. Pleon segment 1 with antero-inferior angle produced forwards, subacute, segment 2 with antero-inferior angle rounded, postero-inferior angle quadrate, inferior margin straight, postero-inferior angle of 3rd segment strongly produced, subacute and somewhat upturned.

Telson a little longer than broad, cleft extending scarcely beyond the centre, apices rounded with a terminal notch containing a spine, lateral margins without spines.

First antenna, 1st joint stout, a little longer than broad, dorsally and ventrally carinate but not produced, flagellum longer than peduncle, 13-jointed, 1st joint nearly equal to 1st peduncular joint, accessory flagellum not observed in either specimen.

Second antenna, 4th and 5th joints subequal, flagellum in ♂ ca. 40-, in ♀ 12-jointed, not calceoliferous.

Epistome not projecting, upper lip with a large compressed lobe in front.

Lower lip, lobes stout, apices setose.

Mandibles, cutting-edge convex, smooth with a small tooth at outer angle, secondary cutting-plate represented in left by a small elongate

process, apically enlarged and finely denticulate, spine-row with 3 spines, molar not very prominent, oblique, palp elongate, arising opposite or a trifle behind molar, 2nd joint $2\frac{1}{2}$ times as long as 3rd, which is twice 1st.

First maxilla, inner plate with 2 setae, outer plate with 2 spines, palp with 9 short, stout spine-teeth.

Second maxilla, inner plate a good deal shorter than outer.

Maxilliped, apex of inner plate truncate, concave, sloping inwards, with 3 small teeth, the largest on the inner apical angle, and 6 setae, outer plate reaching nearly to end of 2nd joint of palp, inner margin with ca. 12 closely set, low-rounded, knob-like denticles, apical margin with 2 longer, curved spines, 3rd joint of palp not quite as long as 2nd. (Cf. Stebbing's figure of the maxilliped of *Tryphosa antennipotens* in Challenger Rep., vol. xxix, pl. vi.)

First gnathopod, 6th joint not quite as long as 5th, both equally wide, 6th not expanding distally, palm transverse with several little fimbriate plates, defined by one stout spine and one shorter one, finger not overlapping palm, inner apex produced in an acute tooth lying close to, but not as long as, unguis.

Second gnathopod, 6th joint scarcely more than $\frac{1}{2}$ length of 5th, a trifle wider but not expanded, palm transverse, its lower angle sub-acutely produced, finger short, curved.

First and second peraeopods, 4th joint a little shorter than 6th, inner margin of 6th with 6 groups of spinules and 2 setae, finger scarcely $\frac{1}{3}$ length of 6th.

Third to fifth peraeopods, 2nd joint large, slightly tapering distally in peraeopods 3 and 4, not in 5, hind margin straight in 3 and 4, rather convex in 5, with very slight serrations, postero-inferior angle rounded, extending to end of 3rd joint, 4th not expanded, 5th a little longer than 4th in peraeopod 3, a good deal longer in 4 (lost in peraeopod 5), in peraeopod 3 6th joint longer than 5th, inner margin with 4 spinules, finger $\frac{1}{3}$ length of 6th, rest of the joints in peraeopods 4 and 5 lost.

Branchial lamellae simple.

First uropod, rami equal, feebly spinulose.

Second uropod, outer ramus as in 1st uropod, inner ramus as long as but broader for $\frac{2}{3}$ its length, then suddenly constricted, distal $\frac{1}{3}$ narrow, pointed, curved, inner distal angle of the broad portion with a long spine-seta, inner margin spinulose.

Third uropod, rami subequal, lanceolate, outer ramus with small 2nd joint, margins spinulose.

Length.—9 mm.

Colour.—In spirit, whitish, semi-pellucid.

Locality.—Cape Point, N.E., distant 40 miles, 560–700 fathoms, 1 ♂, 1 nonovigerous ♀. S.S. "Pieter Faure," 17/9/03. (S.A.M., No. A 2812.)

Lakota rotundatus n. sp.

Body rather compressed. Side-plate 1 subtriangular, inferior angle subacute, concealed by side-plate 2, side-plates 2 and 3 of normal oblong shape. Antero-inferior angle of 1st pleon segment very slightly produced forward, antero- and postero-inferior angles of 2nd and 3rd rounded, inferior margin slightly convex.

Telson twice as long as broad, cleft to centre, each apex with a notch containing a spine, 2 spines on lateral margin.

First antenna, in ♂ 1st joint as long as wide, 3rd apically emarginate on inner side, so that 1st joint of flagellum almost touches 2nd peduncular joint, flagellum 2-jointed, 1st joint nearly equal to the remainder together, inner margin with numerous transverse rows of setae, accessory flagellum reaching to middle of flagellum, 5-jointed, 1st joint as long as the other 4; in ♀ similar but not so stout, accessory flagellum not observed.

Second antenna, in ♂ reaching to 2nd pleon segment, in ♀ not much longer than 1st antenna, 4th and 5th joints subequal, flagellum in ♂ 40-, in ♀ 10-jointed.

Mouth-parts as in the preceding species.

First gnathopod, 6th joint a little shorter than 5th, neither expanded, 6th slightly narrower distally, palm a little oblique, convex, cut into several teeth and defined by 2 spines, finger equal to palm, with a tooth on inner apex.

Second gnathopod, 5th joint a little longer than 3rd, slender, 4th and 6th subequal, oblong, palm transverse, defined by a short stout spine, finger curved, scarcely equalling palm.

First and second peraeopods, 4th joint not expanded, subequal to 6th, finger a trifle more than $\frac{1}{3}$ 6th.

Third to fifth peraeopods, 2nd joint expanded, oblong, narrower distally except in peraeopod 5, anterior margin convex in 3 and 4, concave in 5, hind margin straight in 3 and 4, convex in 5, slightly serrate, postero-inferior angle rounded, reaching beyond end of 3rd, 4th not expanded, 5th in peraeopod 5 slender, 6th in all peraeopods slender, finger $\frac{1}{3}$ 6th, also slender.

First uropod, rami equal, feebly spinulose.

Second uropod, inner ramus a little longer than outer, basal two-thirds broad, with a long spine-seta on rounded apex, then suddenly constricted, the distal one-third slender, curved, and pointed.

Third uropod, rami lanceolate, outer slightly longer than inner, with slender 2nd joint, margins spinulose, the inner margin setulose in addition.

Length.—9 mm.

Colour.—In spirit, whitish.

Locality.—Cape Point, N.E. by E., distant 36 miles, 650 fathoms, 1 ♂, 1 ovigerous ♀; Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 1 ♂, 8 ♀♀; Cape Point, E. $\frac{1}{2}$ N., distant 36 miles, 700–800 fathoms, 1 ♂. S.S. "Pieter Faure," 15/7/03, 20/8/03, and 28/8/03. (S.A.M., Nos. A 2813, A 4545, and A 5910.)

This species is exceedingly close to the preceding when the respective appendages are compared; but it is characterised by the shallower 1st side-plate and the rounded postero-inferior angle of the 3rd pleon segment. This latter feature also separates it from *Chironesimus debruyinii* (Hoek) and the other species of *Lakota*.

Gen. ORCHOMENOPSIS G. O. Sars.

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| 1891. | <i>Orchomenopsis</i> . | Sars, Crust. Norw., vol. i, p. 73. |
| 1893. | „ | Bonnier, Bull. Sci. Fr. Belg., vol. xxiv, p. 174. |
| 1903. | „ | Chevreaux, Bull. Soc. Zool. Fr., vol. xxviii,
p. 93. |
| 1906. | „ | Walker, J. Linn. Soc. Lond., vol. xxix,
p. 44. |
| 1912. | „ | Chilton, Tr. Roy. Soc. Edin., vol. xlviii,
pt. 2, p. 473. |
| 1913. | „ | <i>Ibid.</i> , Mitt. Naturh. Mus. Hamburg, vol.
xxx, p. 56. |

Orchomenopsis chilensis (Heller).

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| 1865. | <i>Anonyx chilensis</i> . | Heller, Novara Crust., p. 129, pl. xi, fig. 5. |
| 1888. | <i>Orchomene musculosus</i> . | Stebbing, Challeng. Rep., vol. xxix,
p. 673, pl. xx. |
| 1888. | „ <i>abyssorum</i> . | <i>Id.</i> , <i>ibid.</i> , p. 676, pl. xxi. |
| 1888. | „ <i>cavimanus</i> . | <i>Id.</i> , <i>ibid.</i> , p. 679, pl. xxii. |
| 1891. | <i>Orchomenopsis obtusa</i> . | Sars, <i>loc. cit.</i> , p. 74, pl. xxvi, fig. 2. |
| 1903. | „ <i>proxima</i> . | Chevreaux, <i>loc. cit.</i> , p. 93, figs. 6a-c. |

1903. *Orchomenopsis rossi*. Walker, *loc. cit.*, p. 45, pl. vii, figs. 18-23.

1912. „ *chilensis*. Chilton, *loc. cit.*, pp. 473-477 (synonymy and references).

Chilton, besides uniting all the above "species" under the one name, was inclined to regard South African specimens as also belonging to this widely distributed species, though possibly as a distinct variety. He points out the main features of the specimens collected at Saldanha Bay by the "Scotia," and in what respects they differ from the other "varieties."

Chilton also noted the resemblance of the 1st gnathopod to that of *O. nodimanus* Walker (1903, J. Linn. Soc. Lond., vol. xxix, p. 44, pl. vii, figs. 13-17). In view of the fact that some of the present specimens show an indication of the tubercle characteristic of that species (absent in Chilton's specimens), there seems some reason for including also *nodimanus* in the above synonymy.

For the sake of comparison I give the following detailed description:

Head subequal to 2nd peraeon segment and shorter than 1st; eyes long, oval, slightly larger below, in ♂ larger than in ♀, and occupying the greater part of the head, nearly meeting on top.

Side-plates 1-4 not more than $1\frac{1}{2}$ times as deep as their segments, widening distally, 5 a little deeper than long, 6 deeper than long, both bilobed, 7 longer than deep, postero-inferior angle rounded.

Postero-inferior angle of 1st pleon segment rounded, of 2nd and 3rd quadrate, inferior margin of 2nd straight, of 3rd convex.

Telson twice as long as broad, cleft to $\frac{4}{5}$ its length, lobes not dehiscent, 1 apical and 1 subapical spinule on each apex and 3 along each side-margin.

First antenna as long as head plus 1st peraeon segment, 1st joint very stout, only a little longer than broad, 2nd and 3rd together equal to half the 1st, 3rd with dense tuft of stout setae, flagellum as long as peduncle, 10-12-jointed, 1st joint largest, accessory flagellum a little more than half the primary flagellum, 6-jointed.

Second antenna in ♀ equal to head plus the first two peraeon segments, 3rd and 4th joints subequal and shorter than 5th, anterior margin of 4th and 5th with short dense setae, flagellum equal to peduncle, 15-jointed; in ♂ reaching almost or quite to the uropods.

Epistome not projecting.

Mandible, palp not longer than trunk.

First maxilla, inner plate very slender, with 2 apical setae, outer

plate with 7 strong apical dentate spines, palp with a number of small apical teeth.

Second maxilla slender, the two plates subequal in length (or inner a trifle shorter), but inner narrower, apices setose, inner margin of inner plate setulose.

Maxilliped, inner plate narrow, outer plate reaching almost to end of 3rd joint of palp, apex rounded, inner distal margin crenulate, 4th joint of palp small.

First gnathopod stout, greatly resembling that of *nodimanus* Wlkr., 2nd joint twice as long as broad, 3rd larger than 4th, 5th very short, hinder angle produced into a narrow, apically rounded lobe, 6th $\frac{3}{4}$ length of 2nd, narrowing distally, palm very short, transverse, forming a right angle with the inferior margin and cut into 4-5 little teeth (sometimes obscure), inferior margin with 2-3 setae and sometimes a very slight indication of a little tubercle about in the middle, finger overlapping palm, 1-3 small spinules and 2-3 setae at junction of palm and inferior margin.

Second gnathopod slender, 2nd joint equal to 4th-6th joints together, 3rd almost as long as 5th, 5th not greatly expanded, its lower distal surface scabrous, 6th equal to 4th, inferior apex produced in an acute "thumb," finger straight, equal to and fitting closely to thumb, anterior apex of 6th with several long stout setae.

No sexual differences in either gnathopod.

First and second pereopods, 2nd joint equal to 4th and 5th together, 5th narrower than 4th and shorter than 3rd, 6th longer than 4th in 1st pereopod, subequal in 2nd, inner margin with 5 spinules, 7th not quite $\frac{1}{2}$ 6th.

Third pereopod, 2nd joint half as broad again as long, hind margin with very slight indents, anterior margin with ca. 12 spinules, 3rd very short with 1 spinule on anterior apex, 4th rather strongly expanded on hind margin, 5th subequal to anterior margin of 4th, 6th half as long again as 5th, anterior margin with 3 spinules, 7th nearly $\frac{1}{2}$ 6th, curved.

Fourth pereopod, 2nd joint longer than broad, hind margin with very slight indents, anterior margin with ca. 9 spinules, 3rd very short, with 1 spine on anterior apex, anterior margin of 4th with 2 setae, of 5th with 2 spines, of 6th with 4 spines.

Fifth pereopod, 2nd joint as broad as long, hind margin with very slight indents, anterior margin with ca. 8 spines, 3rd short, 1 spine on anterior margin and 1 on apex, 4th not so strongly expanded

as in 3rd and 4th pereopods, 4th and 5th subequal, 6th equal to 4th and 5th together.

First uropod very like that of *O. cavimanus* Stebb., peduncle with 5-6 spines on upper margin, rami subequal, shorter than peduncle, upper margins of both with 3 spines.

Second uropod, peduncle with 4 spines, rami subequal, shorter than peduncle, upper margins of both with 3 spines.

Third uropod, peduncle shorter than inner ramus, outer ramus longer than inner, outer margin of outer ramus with 4 spines, inner margins of both rami with plumose setae.

Length.—7 mm.

Colour.—In spirit, whitish or pale pinkish, eyes black or dark red-brown.

Locality.—Simons Bay, 10/3/96, and Somerset Strand, 28/4/98 (Dr. J. D. F. Gilchrist), ♂♂ and ♀♀; Dyer's Island, April 1915 (J. Drury), ♂♂ and ♀♀; Fish Hoek, False Bay, 8 fathoms, 2 ♀♀. S.S. "Pieter Faure," 24/12/02. (S.A.M., Nos. A 140-1, A 3384, and A 3806.)

Geogr. Distribution.—Chile (Heller, *A. chilensis*); South of Japan (Stebbing, *O. musculosus*); East of Buenos Aires, 1100 fathoms (Stebbing, *O. abyssorum*); Kerguelen Island (Stebbing, *O. cavimanus*); Norway, 100 fathoms (Sars, *O. obtusa*); Tropical Atlantic and Graham Land (Chreveux, *O. proxima*); Cape Adare, Antarctic (Walker, *O. rossi*); South Orkneys and Coats Land, 9-161 fathoms (Chilton); Saldanha Bay (Chilton).

Strauss (Wiss. Ergebn. D. Tiefsee Exp., vol. xx, pt. 1, p. 6, pl. i, figs. 1-4, pl. ii, fig. 12, 1909) has discussed the structure of the eye in *O. rossi* Wlkr.

Gen. URISTES Dana.

1849. *Uristes*. Dana, Amer. J. Sci., ser. 2, vol. viii, p. 136.

1916. ,, Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3, p. 126 (references).

Uristes induratus n. sp.

(Plate XXXIV, fig. 3.)

♂. Body moderately stout, integument indurated. Head as long as 1st pereon segment, antero-lateral angles acute. Eyes not distinguishable.

Pereon and pleon segments dorsally rounded. Side-plate 1 extremely small, subsemicircular, concealed by side-plate 2, which

itself is half concealed by 3, 3 considerably deeper than 2, 4 twice as deep as greatest length, postero-inferior angle subacute, emargination moderately deep, 5 as deep as long, subcircular with a very shallow indentation on inferior margin, 6 deeper than long, anterior margin straight, 7 considerably shallower, subsemicircular.

Postero-inferior angle of pleon segment 1 quadrate, of segment 2 quadrate with a small acute point, of 3 produced in a long acute slender point at least half the dorsal length of the segment.

Telson lanceolate, twice as long as basal width, cleft $\frac{2}{3}$ length, apices acute, contiguous.

First antenna, 2nd and 3rd joints together equal to 1st, flagellum 7-jointed, 1st joint long, setose, 6th and 7th elongate and very slender, accessory flagellum shorter than 1st flagellar joint, 2-jointed, both joints slender.

Second antenna not greatly longer than 1st, ultimate peduncular joint shorter than penultimate, flagellum 2-jointed.

Epistome and upper lip not projecting.

Mandible, molar well-developed, palp affixed over molar, short and stout, 2nd joint scarcely, if at all, longer than 3rd.

First maxilla, inner plate with 3 apical setae, outer plate with 8 denticulate spines, palp of the one side with 4 apical spinules, of the other side with 4 stout spines and a spinule.

Second maxilla, outer plate slightly wider than inner.

Maxilliped, inner plate with 3 stout spines on apex, outer plate with 5 or 6 close-set stout, blunt, more or less chisel-shaped spines on inner distal margin, 4th joint of palp not quite equal to 3rd.

First gnathopod, 2nd joint equal to rest of limb, 5th a little longer than 6th, subequal in width, palm oblique, spinose, 5th and 6th not very setose, finger matching palm.

Second gnathopod, 5th and 6th joints subequal in width, 5th considerably longer than 6th, which narrows distally, no palm, the infero-distal angle rounded, finger small.

First and second peraeopods slender, none of the joints expanded, 7th nearly as long as 6th.

Third peraeopod, 2nd joint much smaller than the side-plate, as broad as its anterior length, posteriorly expanded and produced in a distally rounded lobe reaching to middle of 4th joint, hind margin straight, entire, other joints slender.

Fourth peraeopod, 2nd joint twice as long anteriorly as wide, posterior lobe reaching only to end of 3rd, hind margin straight, entire, other joints slender.

Fifth peraeopod, 2nd joint of same proportions as in 4th peraeopod but considerably larger, posterior lobe reaching end of 3rd, hind margin convex, with only 3 widely spaced and very obscure and shallow indents, other joints slender.

First and second uropods slender, outer ramus distinctly shorter than inner.

Third uropod stouter, outer ramus (including 2nd joint) a little longer than inner, both rami narrow lanceolate.

Length.—7 mm.

Colour.—In spirit, whitish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 1 ♂. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4548.)

In general appearance approximating to *U. umbonatus* (Sars), but with the 1st side-plate much smaller. Distinguished from all the species in the genus by the produced postero-inferior angle of pleon segment 3, the small 1st and large 5th side-plates, the 2nd joints of the 3rd–5th peraeopods, especially that of the 3rd, and the mandibular palp.

FAMILY AMPELISCIDAE.

Gen. AMPELISCA Kroyer.

1842. *Ampelisca*. Kroyer, Naturh. Tidsskr., vol. iv, p. 154.

1916. ,, Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3, p. 132 (references).

Ampelisca byblisoides n. sp.

(Plate XXXIV, fig. 4.)

Head equal to first two peraeon segments together, transversely truncate. Eyes apparently absent. Side-plate 1 concealing base of 2nd antenna, 1–3 without a tooth at postero-inferior angle, 4 as deep as long, postero-inferior angle rounded.

Posterior margin of pleon segment 4 raised dorsally into a kind of hood, but not projecting over 5th segment, margin setose. Postero-inferior angle of segment 3 rounded.

Telson nearly half as long again as broad, apices acute with 2–3 setules, dorsal surface with a very few setules on distal portion.

First antenna scarcely more than $\frac{1}{3}$ length of body, 2nd joint not twice length of 1st, 3rd shortest, flagellum 10-jointed.

Second antenna nearly as long as body, ultimate and penultimate peduncular joints subequal, flagellum ca. 26-jointed.

Mandible, 2nd joint of palp linear, longer than 3rd.

First gnathopod, 5th and 6th joints subequal, linear, palm of 6th a little oblique, with 6 short pectinate spine-setae.

Second gnathopod, 5th joint longer than 6th, otherwise similar to 1st gnathopod.

First and second peraeopods, 4th joint slightly expanded distally but scarcely produced, 6th $\frac{1}{2}$ as long again as 5th, 7th not equal to 5th plus 6th.

Third and fourth peraeopods, 2nd joint with hind margin evenly rounded, 3rd and 4th almost without setae, 5th with setae on anterior margin, 2 groups of 3 spinules on posterior margin, a row of 5 spines and 3 long setae on posterior apex, 6th subequal to 5th, 7th simple.

Fifth peraeopod, 2nd joint longer than rest of limb, widening to the transversely truncate distal margin, postero-inferior angle rounded, plumose setae on the distal margin, but none between its expansion and the 3rd joint, 4th wider than and half as long again as 3rd, 5th shorter than 4th but longer than 3rd, 6th scarcely half width of 5th, as long as 3rd, 7th minute, half as long as 6th.

Uropods 1 and 2, peduncle a little longer than rami.

Uropod 3, peduncle extending to apices of rami of uropod 2, rami equal, foliaceous, setose.

Length.—8 mm.

Colour.—In spirit, whitish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 8 specimens, but no ovigerous ♀. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4529.)

This species merits attention on account of its showing a transition between *Ampelisca* and *Byblis*. The 5th peraeopod is of the *Byblis* type, with small 7th joint, but without setae on the 2nd joint between its expansion and the 3rd joint. The 3rd and 4th peraeopods have 2 groups and an apical row of spines on the posterior margin of the 5th joint; this is more than *Ampelisca* has, but, on the other hand, does not reach the strong development of several transverse rows found in *Byblis*.

Ampelisca excavata n. sp.

(Plate XXXIV, figs. 5-7.)

Head equal to first two peraeon segments together, transversely truncate. Eyes 3 on each side, the lower in the antero-lateral angle, the upper some distance within the anterior margin, the 3rd half the size of the other two, behind the upper, cornea not thickened.

Side-plate 1 concealing base of 2nd antenna, 1-3 not notched at postero-inferior angle, inferior margin of 1 but not of 2 and 3 strongly convex, postero-inferior angle of 4 rounded, depth of 4 twice length.

Postero-inferior angle of 3rd pleon segment rounded-quadrate. Pleon without any keels or teeth.

Telson oval, lobes narrow-ovate, apices separated, cleft scarcely extending beyond centre, 2-3 apical setae and 1 subapical on outer margin, none on dorsal surface.

First antenna, $\frac{1}{4}$ length of body, 1st and 2nd joints subequal but 2nd a trifle more slender, 3rd $\frac{1}{2}$ 2nd, flagellum subequal to peduncle, 8-jointed.

Second antenna only a little longer than 1st, 4th and 5th joints subequal, each equal to 2nd plus 3rd, flagellum a little shorter than peduncle, 8-jointed.

Mandible, 2nd joint of palp linear, 3rd $\frac{1}{2}$ 2nd.

Maxilliped, inner margin of outer plate with 7 stout spines, the distal 2 elongate and linear, the others ovate, outer distal angle of 4th joint of palp prominent.

First gnathopod, 6th a little shorter and narrower than 5th, both joints with plumose setae on inferior margin, 6th in addition with serrate spines.

Second gnathopod similar, but longer and more slender.

First and second peraeopods, 4th joint widening slightly distally but not apically produced, inferior apex with 3-4 stout plumose setae, 5th $\frac{1}{2}$ 6th, 7th equal to 5th and 6th together.

Third peraeopod, anterior margin of 2nd joint strongly bulging, 3rd thrice as wide as long, anterior margin of 4th very convex, 5th shorter than 4th, posterior apex produced, posterior margin with 2 pairs of very stout short spines with a single one proximal and another distal to them, apex with 1 stout spine and 2 stout serrulate setae, 6th equal to 5th, posterior margin with 1 spinule, 7th with a spinule on anterior margin.

Fourth peraeopod similar to 3rd, anterior distal margin of 2nd joint with 6 stout plumose setae, 5th joint as in 3rd peraeopod.

Fifth peraeopod, anterior margin of 2nd joint concave proximally, hind margin convex, expanded, distal hind margin semicircularly excavate, postero-inferior apex bilobed and reaching to middle of 5th joint, a few simple setae on hind margin, none between expansion and 3rd and 4th joints, 4th thrice as long as 3rd, 4 stout plumose setae on hind margin, 5th $\frac{1}{2}$ 4th with a short stout spine on hinder

apex, 6th a little longer than 5th, linear, 7th shorter than 5th, linear, apically blunt.

First uropod, peduncle stout, outer ramus subequal to peduncle, curved, inner ramus shorter and more slender than outer.

Second uropod stout, rami shorter than peduncle, outer a trifle longer than inner, apex bifid, upper margin with 3 stout short spines, inner ramus apically acute, with 1 spinule on upper margin.

Third uropod stout, outer ramus narrow lanceolate, apex acute, entire, a small subapical notch on inner margin, inner and outer margins distally with a few short setae, inner ramus longer than outer, stout, tapering to a bifid apex, a strong subapical tooth on inner margin, and a subapical tuft of short setae on outer margin.

Length.—7 mm.

Colour.—Whitish, both antennae and the ocular pigment crimson.

Locality.—Buffels Bay (False Bay), 1/3/15 (K.H.B.), 1 immature specimen. (S.A.M., No. A 3289.)

This species is remarkable for the stoutness of the 3rd and 4th peraeopods. The 5th peraeopod and the telson are also distinctive. Up to the present no further specimens have come to hand.

FAMILY HAUSTORIIDAE.

Gen. *PLATYISCHNOPUS* Stebb.

See 1916. Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3, p. 142.

Platyischnopus capensis n. sp.

(Plate XXXIV, figs. 13, 14.)

1914. *Platyischnopus mirabilis*. Stebbing, Ann. S. Afr. Mus., vol. xv, pt. 1, p. 32 (non-Stebbing, 1888).

1916. „ „ Barnard, *loc. cit.*, p. 142 (quotes Stebbing).

Since the publication of the last-mentioned paper, the discovery of a male specimen has led me to examine the Saldanha Bay specimen identified by Stebbing as *mirabilis*. I regret that I cannot accept this determination. The specimens agree far more closely with *P. herdmanni* Wlkr., though there are features which in my opinion entitle them to be regarded as a new species.

Head equal to first 3 peraeon segments, resembling *mirabilis*. Eyes present. First 3 peraeon segments subequal, 4th–7th segments increasing in length.

Third pleon segment with 1 dorsal tooth flanked by 2 subdorsal teeth as in *herdmani*, but considerably smaller and easily overlooked. Postero-inferior angle of 2nd and 3rd segments acutely produced and upturned.

Telson similar to that of *mirabilis*, but narrower in proportion to its length, the apical notch also narrower, but the lobes still divergent, not contiguous as in *herdmani*, each lobe with a small tooth on outer margin from which arises a seta, 2 groups of setae on the dorsal surface.

First antenna in ♂ as described by Walker for *herdmani*, 1st joint swollen, twice as broad as long, 2nd twice as long as 3rd, which has a dense fringe of setae round the distal end, flagellum reaching to end of 1st uropods, very slender, 1st joint longest, accessory flagellum 3-jointed; in ♀ 2nd joint longer and stouter than 3rd, flagellum 5-jointed, with apical setae, accessory flagellum 2-jointed.

Second antenna more slender in ♂ than in ♀, but otherwise similar, 4th joint much the longest and stoutest, twice as long as 5th, more strongly setose than in *herdmani*, with an apical tuft of long setae, flagellum slender, 3-jointed.

First gnathopod, 3rd joint $\frac{1}{3}$ length of 2nd, 5th equal to 3rd plus 4th, 6th similar to that of *mirabilis*, but not so produced, similar in the two sexes but a little more slender in ♂ than ♀.

Second gnathopod, 3rd joint $\frac{1}{3}$ length of 2nd, 5th much longer than in 1st gnathopod, twice length of 3rd, 6th $\frac{1}{3}$ length of 5th, resembling that of *herdmani*, whole limb more slender in ♂ than ♀.

Peraeopods 1 and 2 similar to those of *herdmani*, 5th joint with apical tuft of setae, 6th with about 10 apical spine-setae, which are distinctly not so stout or so long as 7th joint.

Peraeopod 3 resembling that of *herdmani*, the 2nd joint not so stout as in *mirabilis*.

Peraeopod 4 as figured for *mirabilis*, but 2nd joint almost as broad as long.

Peraeopod 5, 2nd joint distinctly longer than broad, resembling that of *herdmani*, but with 3 teeth on distal hind angle in addition to the actual postero-inferior angle, which is also acute. It may be remarked that in Walker's figure the 3rd joint has been omitted; it is let into the 2nd, appearing at first sight to be part of this joint, and is consequently easily overlooked. Remaining joints as in *herdmani*.

First and second uropods slender, 1st longer than 2nd, 2-3 stout curved spines on distal upper margins of the peduncles, rami of both

slightly longer than their peduncles, the outer ramus of both being slightly longer than the inner. Similar in both sexes.

Third uropod in ♂ extending much beyond the other uropods, peduncle short, moderately stout, with long apical setae on lower margin, one ramus no longer than peduncle, ovate-lanceolate, apex acute, the other ramus nearly 4 times length of peduncle, narrow linear, with groups of short spines on outer margin and long plumose setae on inner margin, at the apex a long stout spine nearly $\frac{1}{2}$ length of ramus. In ♀ similar to ♂, but not so elongate, the long ramus with groups of short spines on *both* margins and no plumose setae.

With regard to the relative positions of these rami, Stebbing assumes that the *long* one is the *outer*, whereas Walker expects "the inner ramus to be long and easily detached as in the case of some of the *Gammaridae*." But in the *Gammaridae* it is the *outer* ramus which is the longer of the two, and such is also the case here. The two rami appear in profile to arise one above the other, the shorter one above; but when viewed from above the *shorter* one is distinctly seen to be the *inner*, and converging slightly towards its fellow.

Length.—6 mm.; including 3rd uropods in ♂, 7.5 mm.

Colour.—In spirit, pale yellowish.

Locality.—Saldanha Bay, 10 fathoms, 1 ♀ (Stebbing); from stomach of White Stumpnose (*Chrysophrys globiceps*) caught in Table Bay, 1906, 1 ♂. (S.A.M., Nos. A 3895 and A 4389.)

As remarked, this species is close to *herdmani*, the chief distinction being in the telson. Both agree in having dorsal teeth on the 3rd pleon segment and in the shape of the 5th peraeopod, which features separate them sharply from *mirabilis*.

FAMILY PHOXOCEPHALIDAE.

Gen. HARPINIA Boeck.

1876. *Harpinia*. Boeck, Skand. Arkt. Amphip., vol. ii, p. 218.

1910. „ Stebbing, Gen. Cat. S.A. Crust., p. 452 (references).

Harpinia excavata Chevr.

1887. *Harpinia excavata*. Chevreux, Bull. Soc. zool. Fr., vol. xii, p. 568.

1908. „ „ Stebbing, S.A. Crust., pt. 4, p. 73 (references).

1910. „ „ *Id.*, loc. cit., p. 452.

A female specimen agrees with Chevreux's figures, except that the hind margin of the 2nd joint of 5th peraeopod is perfectly entire; a magnification of 450 diam. failed to disclose any crenulations.

The inner ramus of 3rd uropod is as long as the 2-jointed outer ramus, as noted by Stebbing.

Length.—4 mm.

Colour.—In spirit, whitish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 1 ♀. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4522.)

Geogr. Distribution.—Bay of Biscay, 5110 metres, and off Cape Finisterre, 363–510 metres (Chevreux); off Cape Peninsula, 245 fathoms (Stebbing).

FAMILY AMPHILOCHIDAE.

Gen. CYPROIDEA Hasw.

1880. *Cyproidea*. Haswell, Ann. Mag. Nat. Hist., ser. 5, vol. v, p. 31.

1880. *Cyproidia* (part). *Id.*, Proc. Linn. Soc. N.S.W., vol. iv, p. 320.

1900. *Cyproidea*. Chilton, Ann. Mag. Nat. Hist., ser. 7, vol. v, p. 243.

1906. „ Stebbing, Das Tierreich, 21, pp. 157, 723.

Cyproidea ornata (Hasw.).

1880. *Cyproidea* sp. (part). Haswell, *loc. cit.*, p. 31.

1880. *Cyproidia ornata*. *Id.*, *loc. cit.*, p. 320, pl. xviii, fig. 1.

1906. *Cyproidea* „ Stebbing, *loc. cit.*, p. 158.

These specimens agree exactly with Stebbing's description in "Das Tierreich."

Length.—4 mm.

Colour.—In spirit, yellowish-white, tips of the antennae pink.

Locality.—Port Shepstone, Natal, September 1916 (H. C. Burnup), 16 specimens. (S.A.M., No. A 4191.)

Geogr. Distribution.—Australia.

Gen. GITANOPSIS G. O. Sars.

See 1916. Barnard, Ann. S.A. Mus., vol. xv, pt. 3, p. 144.

Gitanopsis pusilla Brnrd.

1916. *Gitanopsis pusilla*. Barnard, *loc. cit.*, p. 144, pl. xxvi, figs. 11, 12.

A single specimen from the " Pieter Faure " collection (Lion's Head, Cape Town, S.E. $\frac{1}{4}$ E., distant 50 miles, 230 fathoms, 2/4/02) is inseparable from the specimens originally described from littoral waters. The process of the 5th joint of the 2nd gnathopod is not quite so long. There is no trace of eyes, but this might well be due to the method of preservation. The telson is exactly similar.

As regards the bathymetrical range, it must be borne in mind that the " Pieter Faure " used no closing nets of any kind, so that the possibility of the present specimen having been taken in surface waters near floating weed is not excluded. Since, however, the specimen was found in a bottle of mixed Starfish, Hydroids, Gasteropods, etc., its deep-water origin is probable.

Chilton (1923, Rec. Austr. Mus., xiv, 2, p. 82) considers this species to be a synonym of *Amphilochus neapolitanus* Della Valle, a species found in Europe, Australasia, and India. As I have not had the same opportunities for comparison that Dr. Chilton has, I am not in a position to offer any further remarks on the question. The colour-pattern, however, appears to be different.

FAMILY LEUCOTHOIDAE.

Gen. LEUCOTHOE Leach.

See 1916. Barnard, Ann. S.A. Mus., vol. xv, pt. 3, p. 148.

1923. Chilton, Rec. Austr. Mus., vol. xiv, pt. 2, p. 85.

Leucothoe ctenochir n. sp.

(Plate XXXIV, fig. 8.)

Antero-lateral angles of head rounded. Eyes moderately large, oval. Side-plate 1 scarcely widened below, 2 oblong, longer than deep, antero- and postero-inferior angles of both 1 and 2 quadrate, 3 slightly deeper than 1 and 2, about as deep as long, angles rounded-quadrate, 4 deeper than long, deepest at rounded anterior angle, posterior emargination very shallow.

Postero-inferior angles of pleon segments 2 and 3 sub-quadrate, 3rd without sinus.

Telson ovoid, only half as long again as broad, and only half as long as total length of 3rd uropod, apex broadly rounded.

First antenna reaching end of 3rd peraeon segment, moderately stout, 1st and 2nd joints subequal in length, but 1st stouter than 2nd, 3rd $\frac{1}{4}$ 2nd, flagellum equal to 2nd, 8-jointed, accessory flagellum indistinguishable.

Second antenna subequal to 1st, ultimate peduncular joint shorter than penultimate, slender, flagellum scarcely half length of last peduncular joint, 3-jointed.

Mandibular palp moderately long, slender, 3rd joint longer than 1st, but shorter than 2nd.

First gnathopod, 2nd joint stout, thrice as long as broad, 5th circular at the base, from which arises the very slender process, curving gently downwards and then turned sharply up at the extreme apex, inner margin smooth, 6th ovoid and stout at the base, narrowing into the slender distal portion, inner margin smooth, 7th scarcely $\frac{1}{6}$ length of 6th, slender, curved.

Second gnathopod, 2nd joint stout as in 1st gnathopod, anterior apical angle slightly lobed, rounded, 3rd rather more prominently lobed on anterior margin, 5th produced in a narrow subulate process, apically acute, 6th ovate, palm longer than hind margin, with 6 strong and regular narrow teeth (including the one at the defining angle) resembling a comb, the tooth nearest the finger-hinge obscurely bifid at the apex, finger matching palm, slender, evenly curved.

Peraeopods not very slender, very feebly armed with spines.

First, 2nd, and 3rd uropods also nearly spineless, 3rd uropods extending beyond the 1st and 2nd pairs.

Length.—6.5 mm.

Colour.—In spirit, yellowish, eyes dark red-brown.

Locality.—Port Shepstone, N. distant 8 miles, 36 fathoms, 1 specimen. S.S. "Pieter Faure," 14/3/01. (S.A.M., No. A 4404.)

This species is easily distinguished by the beautiful comb-like armature of the palm of the 2nd gnathopod.

Leucothoe dolichoceras Brnrd.

1916. *Leucothoe dolichoceras*. Barnard, Ann. S.A. Mus., vol. xv, pt. 3, p. 151, pl. xxvi, fig. 14.

The discovery of further specimens in the "Pieter Faure" collection enables me to confirm the original description, and to make one or two additions thereto.

The better preserved specimens show well-developed eyes, moderate in size, ovoid, and black in colour. In some of the specimens, however, the eyes are only slightly darker than the rest of the animal: a difference which is probably due to the method of preservation, although "3 per cent. formalin" is given in the record book as the fluid used in all cases.

The 3rd uropods, like the 1st and 2nd pairs, are almost spineless.

In adult specimens there is a characteristic bend or kink in the 5th joint of the 1st gnathopod, the distal process curving downwards away from the axis of the basal portion.

A series of specimens of all ages shows that up to about 5-6 mm. in total length the palm of the 2nd gnathopod is practically smooth. At this size slight denticles begin to appear, chiefly visible near the finger-hinge. At about 8-10 mm. there are 3 clearly defined, flat-topped denticles, the one nearest the finger-hinge being bifid. After this the adult form is rapidly assumed, the hand becoming narrower and the palmar denticles stronger.

Additional Localities.—Umkomaas River mouth, N.W. by W. $\frac{1}{2}$ W., distant 5 miles, 40 fathoms, 3 specimens; False Bay, 11-13 fathoms, 3 lots of several specimens. S.S. "Pieter Faure," 31/12/00, 24/8/03, and 19/11/03. (S.A.M., Nos. A 4409-A 4412.)

Lives in the "Cauliflower" Alcyonarian *Capsella rugosa* Kükenth.

FAMILY STENOTHOIDAE.

Gen. STENOTHOE Dana.

See 1916. Barnard, Ann. S.A. Mus., vol. xv, pt. 3, p. 153.

1923. Chilton, Rec. Austr. Mus., vol. xiv, pt. 2, p. 95 (discussion of *S. valida* Dana and synonyms).

1924. *Id.*, Tr. N.Z. Inst., vol. lv, p. 270.

Stenothoe gallensis Wlkr.

1904. *Stenothoe gallensis*. Walker in Herdman's Ceylon Pearl Fish. Suppl. Rep., 17, p. 261, pl. iii, fig. 19.

1916. „ „ Barnard, *loc. cit.*, p. 154.

The identification of the Durban specimens, which rested on female specimens only, is now confirmed by a male forwarded to me by Mr. H. C. Burnup.

The shape of the 2nd joint of the ramus of the 3rd uropod is quite distinctive, although in the present specimen it is not the same as in Walker's figure, but corresponds exactly with Kunkel's figure (Tr. Conn. Ac. Sci., vol. xvi, p. 17, fig. 5) of the same appendage in a Bermudan specimen of *S. valida* Dana.

The line of demarcation between the distal joint and its "blunt projection" shown in Kunkel's figure is here absent. Kunkel had a ♂ and a ♀ under examination, and, for aught he says to the contrary,

the ♀ shows the same peculiarity in the 3rd uropod as the ♂. This peculiar shape seems to be abnormal, to judge from Stebbing's description in "Das Tierreich." I have not seen Dana's figures, but if his figure had shown a suddenly constricted 2nd joint, Stebbing would hardly have described it merely as "longer than 1st."

It is therefore interesting to find the same peculiarity in the South African specimen, and at first it seemed that the specimen must be assigned to *valida*. But a glance at the 2nd joint of the 3rd pereopod at once showed that this joint was narrow linear as in *gallensis*, instead of broadly oval as in *valida*. The specimen therefore must be regarded as belonging to *gallensis*, with the 3rd uropod abnormal, *i.e.* different from that originally described by Walker. The need of very much more abundant material is here only too patent.

Another question which also awaits solution is whether *gallensis* should not become a synonym of the Mediterranean species *cattai* Stebb., 1906, which has a *geniculate* 2nd joint to the ramus of the 3rd uropod, and a 2nd gnathopod similar to *valida* and *gallensis*.

Length.—♂ 4 mm.

Colour.—In spirit, white, eyes distinct.

Locality.—Port Shepstone, Natal, September 1916 (H. C. Burnup), 1 ♂. (S.A.M., No. A 4194.)

Stenothoe assimilis Chevr.

1908. *Stenothoe assimilis*. Chevreux, Bull. Inst. océan. Monaco, No. 113, p. 4, figs. 4-6.

A male specimen agreeing with the description and figures, except in having the inferior margin of side-plate 2 scarcely concave, and the flagella of the antennae longer: that of antenna 1 being ca. 24-jointed, that of antenna 2 ca. 18-jointed.

This species is distinguished from the preceding by the entire (not crenulate) inferior margin of the 4th joint of gnathopod 2 in ♂, the less developed gnathopod 2 in ♀, the more quadrangular shape of side-plate 2, and the straight conical 2nd joint of the ramus of uropod 3.

Length.—5 mm.

Colour.—Ivory-white, semitransparent, with pink spots on back and at base of side-plates, eyes crimson.

Locality.—Durban Harbour, 5 fathoms (H. W. Bell-Marley), 1 ♂, 1/5/17; Cape Town Harbour, on floating boom (R. W. E. Tucker), 3 ♂♂, 2 ovigerous ♀♀, 1 juv., April 1918. (S.A.M., Nos. A 4579 and A 5882.)

Geogr. Distribution.—Monaco, Mediterranean.

This species is considered by Chilton (1923, *loc. cit.*, *supra*, p. 99) as a synonym of *S. valida* Dana.

FAMILY COLOMASTIGIDAE.

1899. *Colomastidae*. Chevreux, C.R. Ass. franc. Sess., 27, vol. ii, p. 483.
 1899. *Colomastigidae*. Stebbing, Ann. Mag. Nat. Hist., ser. 7, vol. iv, p. 211.
 1906. „ *Id.*, Das Tierreich, 21, p. 206.
 1910. *Colomastixidae*. Chevreux, Mem. Soc. zool. Fr., vol. xxiii, p. 202.

Gen. COLOMASTIX Grube.

1861. *Colomastix*. Grube, Ausfl. Triest., p. 137.
 1862. *Cratippus*. Bate, Cat. Amph. Brit. Mus., p. 275.
 1869. *Exunguia*. Norman, in Brady and Robertson, Ann. Mag. Nat. Hist., ser. 4, vol. iii, p. 359.
 1893. *Colomastix*. Della Valle, F. u. Fl. Neapel, vol. xx, p. 854.
 1906. „ Stebbing, *loc. cit.*, p. 206.
 1912. „ Chilton, Tr. Roy. Soc. Edin., vol. xlviii, pt. 2, p. 484.

Colomastix pusilla Grube.

1861. *Colomastix pusilla*. Grube, *loc. cit.*, p. 137.
 1864. „ „ *Id.*, Arch. Naturg., vol. xxx, p. 206, pl. v, figs. 2, 2a-b.
 1893. „ „ Della Valle, *loc. cit.*, p. 854, pl. vi, fig. 2, pl. lxi, figs. 23-37.
 1906. „ „ Stebbing, *loc. cit.*, p. 207 (references).
 1907. „ „ Walker, Nat. Ant. Exp., vol. iii, p. 38.
 1909. „ *crassimanus*. *Id.*, Tr. Linn. Soc. Lond., vol. xii, p. 332.
 1910. „ *pusilla*. Chevreux, *loc. cit.*, p. 202.
 1910. „ „ Kunkel, Tr. Conn. Ac. Sci., vol. xvi, p. 21, fig. 7.
 1912. „ „ Pearse, Pr. U.S. Nat. Mus., vol. xliii, p. 370, fig. 2.

Eyes rather large, consisting of 18-21 ommatidia. Serrulations on antenna 2 very obscure. Mouth-parts as in Della Valle's figures.

Gnathopod 1 in ♂ atrophied, as in Della Valle's figure. Uropod 3 with rami subequal, or the outer very slightly longer; serrations on the rami of all the uropods extremely obscure. Telson suboval, apically rounded.

Length.—4 mm.

Colour.—In spirit, yellowish, eyes of same colour (A 4550), or red (A 4551).

Locality.—Between Roman Rock and Cape Recife, 17 fathoms, 2 ♂♂, 2 ovigerous ♀♀, 3 juv. in sponges; Cape Point, N.E. $\frac{1}{4}$ N., distant 18 miles, 135 fathoms, 1 ♀ in a sponge. S.S. "Pieter Faure," 12/12/98 and 27/2/02. (S.A.M., Nos. A 4550 and A 4551.)

Geogr. Distribution.—France, Great Britain, Mediterranean, 12–75 metres (Stebbing, Chevreux, etc.); Red Sea (Walker); Bermuda (Kunkel); Gulf of Mexico, 25–27 fathoms (Pearse); McMurdo Sound, Antarctic (Walker).

It is probable that *C. brazieri* Hasw. from Port Jackson (Haswell), Otago, New Zealand (Chilton), and the South Orkneys (Chilton) will eventually be united with *pusilla*.

FAMILY 'PARDALISCIDAE.

Gen. HALICE Boeck.

- | | | |
|-------|-----------------|---|
| 1871. | <i>Halice</i> . | Boeck, Forh. Selsk. Christian., 1870, p. 152. |
| 1893. | „ | G. O. Sars, Crust. Norw., vol. i, p. 411. |
| 1893. | „ | Della Valle, F. u. Fl. Neapel, vol. xx, p. 661. |
| 1906. | „ | Stebbing, Das Tierreich, 21, p. 228. |
| 1912. | „ | Chevreux, Bull. Inst. océan. Monaco, No. 233, p. 1. |

Halice anacantha n. sp.

(Plate XXXIV, fig. 12.)

Body moderately stout. Rostrum small. Eyes absent. Peraeon and pleon without any dorsal teeth. Side-plate 1 with acute antero-inferior angle, the other side-plates rather deeper than in *H. abyssi* Boeck. Postero-inferior angle of pleon segment 3 subquadrate.

Telson twice as long as broad, cleft nearly to base, lobes rather stout, not strongly dehiscent, apices bifid.

First and second antennae as in *H. abyssi*, accessory flagellum of 1st antenna in ♂ with enlarged basal joint.

Mandible, trunk normal, palp slender, 3rd joint almost as long as 2nd, ending in a long seta.

The other mouth-parts as figured by Sars for *abyssi*.

First gnathopod as in *abyssi*, but 5th and 6th joints less setose on lower margin.

Second gnathopod, 5th joint subequal to 6th, both densely setose.

First and second peraeopods stout, more so in female than in male, 2nd joint elongate ovate, 4th subtriangular, wider than 2nd, 5th in ♂ not quite as long or as wide as 4th, in ♀ larger than 4th, 6th abruptly narrower, slender, longer than 4th, hind margins of 4th–6th with plumose setae.

Peraeopods 3–5 as in *abyssi*.

Uropods 1 and 2 normal; uropod 3 apparently also normal, but more or less mutilated in all the specimens.

Length.—5–6 mm.

Colour.—In spirit, whitish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 3 ♂♂, 4 ♀♀. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4525.)

This species is easily distinguished from *H. abyssi* and *aculeata* Chevr. by the absence of teeth on the pleon and the stout 1st and 2nd peraeopods. The mandibular palp is more like that of *Pardaliscopsis tenuipalpa* Chevr., 1911, than that of any of the other members of the family; it is quite unlike that of *H. abyssi*—but then that of *H. aculeata* shows the transition between a very short and an elongate 3rd joint.

It might be thought that in consequence of the elongate 3rd palpal joint of the mandible the species should be placed in *Pardaliscella* Sars; but all the other characters point to its relation with *Halice*, although it is to be regretted that the 3rd uropods are not better preserved.

FAMILY OEDICEROTIDAE.

Gen. OEDICEROIDES Stebb.

1888. *Oediceroides*. Stebbing, Challeng. Rep., vol. xxix, p. 843.

1916. „ Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3, p. 162 (references).

Oediceroides plumicornis n. sp.

Body compressed, slender. Rostrum slender, acute, slightly deflexed, extending to end of 1st joint of 1st antenna. Ocular pigment forming an obscure median longitudinal stripe on base of rostrum. Antero-lateral angles of head subacute. Peraeon dorsally smooth. Side-plate 1 produced forwards, 4 moderately excavate

behind. Pleon segment 3 rather tumid dorsally above the base of the 4th segment, postero-inferior angle rounded, setose.

Telson oval, 2-3 setules on the broadly rounded apex.

First antenna half length of 2nd, 2nd joint barely as long as 1st, more slender, with numerous long plumose setae on upper margin, 3rd scarcely $\frac{1}{2}$ 2nd, flagellum not as long as peduncle, ca. 12-jointed.

Second antenna, penultimate peduncular joint stout, widest at base, thence tapering evenly, ultimate joint distinctly more slender, $\frac{2}{3}$ length of penultimate, flagellum equal to last 2 peduncular joints together, multiarticulate, with calceoli on anterior margin.

Mandible similar to that of *O. cinderella* Stebb.

First gnathopod, 5th joint not as broad as 6th, which is somewhat similar to that of *O. rostratus* (Stebb.), but with a little longer hind margin, palm minutely, but very distinctly, pectinate (cf. *O. proximus* Bonn., but the denticles are more acute).

Second gnathopod, 5th joint a little wider than 6th, which is more elongate than in 1st gnathopod, palm defined by 3 spines, pectinate as in 1st gnathopod.

All the peraeopods slender; 2nd joint of 5th peraeopod pyriform.

Uropods 1 and 2, peduncle longer than the subequal rami.

Uropod 3 shorter than the preceding, but in all the specimens either lost or damaged.

Length.—7-8 mm.

Colour.—In spirit, whitish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, ♂♂ and ♀♀, some ovigerous. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4521.)

Closely allied to *O. proximus* Bonn., but lacking the ornamentation on the 1st-3rd pleon segments and differing in the shape of the 6th joint of 1st peraeopod. Distinguished from all the species by the plumose 1st antenna.

The preservation of the specimens is not all that could be desired. In stained preparations the ocular pigment seems to extend to the apex of the rostrum, though in very limited amount. Attempts at further elucidation of this point by means of microtome sections were not successful.

Gen. ACEROIDES G. O. Sars.

1892. *Aceroides*. G. O. Sars, Crust. Norw., vol. i, p. 340 (*Aceropsis* on plate 120, sed non Stuxberg).

1906. „ Stebbing, Das Tierreich, 21, p. 254.

The following species does not quite fit in with Stebbing's diagnosis, thus: the lower lip resembles that of *Perioculodes*, the inner plate of 1st maxilla has 6 setae instead of 1, as figured by Sars for *A. latipes* (*loc. cit.*, pl. cxx), the antennae have much longer peduncles, and side-plate 1 is different in shape.

But as there are already 10 monotypic genera, out of a total of 20, in the family, it does not seem advisable to multiply the number still more for the reception of the present species.

The characters of *Arrhinopsis* Stappers, 1911, are unknown to me.

Aceroides limicola n. sp.

(Plate XXXIV, figs. 9, 10.)

Body moderately tumid. Head with a distinct though very small rostral projection, not extending as far forward as the subtruncate lateral angles. Eyes absent. Peraeon and pleon smooth. Side-plates rather deep, inferior margins crenulate and setose, 1 expanded below, 2-4 increasing in size, inferior margin of 3 and 4 emarginate, lobes of 5 subequal, posterior lobe of 6 larger than the anterior.

Telson oblong, very slightly longer than broad, postero-lateral angles rounded, distal margin very slightly emarginate.

First antenna about $\frac{1}{3}$ total length, 1st joint considerably thicker than the following, 2nd joint longest, 3rd shortest, flagellum subequal to 1st peduncular joint, ca. 17-jointed, no accessory flagellum.

Second antenna subequal to 1st, 4th and 5th joints subequal, flagellum slightly longer than ultimate peduncular joint, ca. 7-jointed. Calceoli not developed on either antenna.

Upper lip broader than long, distal margin feebly convex.

Lower lip, inner lobes completely coalesced.

Mandibles closely resembling Stebbing's figures of those of *Oediceroides rostratus* (Challeng. Rep., vol. xxix, pl. lx), molar well developed, palp elongate, slender, 2nd joint straight, 3rd equal to 2nd.

First maxilla, inner plate with 5-6 plumose setae on inner distal margin, outer plate with 8 spines.

Maxilliped, inner plate scarcely reaching more than half-way along 1st joint of palp, outer plate reaching $\frac{3}{4}$ along 2nd palpal joint.

First gnathopod, 4th joint produced in a conical, apically subacute process nearly as long as that on the 5th joint, which reaches the defining angle of palm, 6th widest across the middle, palm oblique, subequal to hind margin, convex, minutely and irregularly denticulate, a submarginal row of spines with a stronger one at the defining angle, finger just overlapping palm.

Second gnathopod, 4th joint ending in a short conical point, not so produced as in 1st gnathopod, and not nearly so long as process of 5th joint, which reaches defining angle of palm, 6th more elongate than in 1st gnathopod, with the palm distinctly shorter than hind margin, but otherwise similar.

Peraeopods 1 and 2 stout, 2nd joint $2\frac{1}{2}$ times as long as broad, 4th-6th distally expanded as in *A. latipes*, but 7th abruptly narrower than 6th, unguiform, not expanded, shorter than 6th, 4th-6th strongly armed with spine-setae.

Peraeopods 3 and 4 also stout, 2nd joint ovate, scarcely twice as long as broad, anterior margin with dense fringe of simple setae, posterior margin crenulate, with plumose setae, 4th equal to 2nd, distally expanded, 5th not half as long as 4th, also expanded, but not as broad as 4th, 4th and 5th strongly armed with spine-setae, 6th considerably longer than 5th, but not equal to 4th, abruptly narrower than 5th, linear, gently curved, anterior margin with small spinules at regular intervals, posterior margin with 2-3 groups of setae, 7th about $\frac{1}{4}$ length of 6th, stout.

Peraeopod 5 as usual in the family, 2nd joint widest at base, postero-basal angle rounded, 5th and 6th subequal, slightly shorter than 4th, 7th lost.

Uropods 1 and 2, rami subequal, slightly shorter than peduncle.

Uropod 3 not extending beyond the others, rami subequal, longer than peduncle.

Length.—15 mm.

Colour.—In spirit, dull pinkish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 1 ♂. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4419.)

The particular features of this species are: the expansion of the 2nd, 4th, and 5th joints, and the narrowness of the 6th joint of the 3rd and 4th peraeopods; the production of the 4th joint of the 1st and 2nd gnathopods into a pointed process, nearly as long as that of the 5th joint in the 1st gnathopod, though considerably shorter in the 2nd.

Gen. PERIOCULODES Sars.

1892. *Perioculodes*. G. O. Sars, Crust. Norw., vol. i, p. 312.

1904. „ Walker in Herdman's Ceylon Pearl Fish.
Suppl. Rep., 17, p. 262.

1906. „ Stebbing, Das Tierreich, 21, pp. 237, 726.

Periiculodes longimanus (Bate and Westw.).

1868. *Monoculodes longimanus*. Bate and Westwood, Brit. Sess. Crust., vol. ii, p. 507.
 1892. *Periiculodes* „ Sars, *loc. cit.*, p. 313, pl. cx, fig. 2, pl. cxi, fig. 1.
 1893. *Oediceros* „ (part). Della Valle, F. u. Fl. Neapel, vol. xx, p. 547, pl. iv, fig. 9; pl. xxxiii, figs. 32-36.
 1906. *Periiculodes* „ Stebbing, *loc. cit.*, p. 237, fig. 61.
 1910. „ „ Chevreux, Mem. Soc. Zool. Fr., vol. xxiii, p. 205.

Agreeing with the description and figures, except that there is no trace of eye pigment or lenses, and the processes of the 5th joint in gnathopods 1 and 2 are not quite so slender as in Sars' figures.

A curious feature is that both the 3rd uropods appear to consist of a short peduncle only, which tapers to a blunt apex at the level of the telsonic apex. They have evidently not been mutilated in the course of capture. They are probably in process of regeneration. If this degenerate or simple form of uropod were the normal, the case would be unique in the family. As there is only the one specimen, there is no other course but to identify it with *P. longimanus*.

Length.—5 mm.

Colour.—In spirit, dull pinkish.

Locality.—Duminy Point (off Saldanha Bay), E. by N. $\frac{1}{2}$ N., distant 8 miles, 87 fathoms, 1 ♂. S.S. "Pieter Faure," 17/3/02. (S.A.M., No. A 5971.)

Geogr. Distribution.—North Atlantic, Mediterranean. Closely allied species (*P. megapleon* Giles, and *P. serra* Walker) in the Indian Ocean.

Gen. SYNCHELIDIUM Sars.

1892. *Synchelidium*. G. O. Sars, Crust. Norw., vol. i, p. 317.
 1906. „ Stebbing, Das Tierreich, 21, p. 241.

Synchelidium (? *tenuimanum* Norm.).

See Stebbing, *loc. cit.*, p. 243.

As there is only a single specimen, and the species of this genus are so closely allied, it seems preferable not to identify the specimen definitely.

One distinguishing character is the presence in two of the species

of brown blotches, which Sars says are retained even after a long while in spirit (*loc. cit.*, p. 319). As a general rule it is to be noted that colours are exceedingly fleeting in spirit, so that little importance can be attached to this point.

The present specimen, after several years' preservation, is perfectly pellucid. As far as structural characters are concerned it appears to agree best with *tenuimanum* Norman, 1895, having the very slender 6th joint of the second gnathopod found in this species.

Length.—4 mm.

Colour.—In spirit, pellucid, pale pinkish.

Locality.—Vasco da Gama (Cape Peninsula), N. 40° E., distant 13 miles, 120 fathoms, 1 specimen. S.S. "Pieter Faure," 4/5/00. (S.A.M., No. A 5970.)

Geogr. Distribution.—The genus has been recorded from the North Atlantic, Mediterranean, and Ceylon.

FAMILY TIRONIDAE.

Gen. SYRRHOITES G. O. Sars.

1893. *Syrrhoites*. G. O. Sars, Crust. Norw., vol. i, p. 391.

1906. ,, Stebbing, Das Tierreich, 21, p. 279.

Syrrhoites tenellus n. sp.

Body slender, deeper in ♀ than in ♂. Rostrum extending nearly to the end of 1st joint of 1st antenna, only slightly deflexed. In ♂ peraeon segments 6 and 7 and pleon segments 1–4 carinate, but not strongly, the posterior angles quadrate but not produced into upturned teeth; in ♀ similar, but keels a little stronger, and a small very slightly upturned tooth on pleon segment 6. Side-plate 3 scarcely widened below, 4th less deep, subacute below. Postero-inferior angle of pleon segment 1 rounded, of segments 2 and 3 quadrate, with a small shortly produced point, not upturned, margin above entire. Posterior margin of 6th segment not fimbriate.

Telson elongate, cleft to the centre, apices acute.

First antenna, 1st and 2nd joints subequal, 3rd shorter, flagellum 7-jointed, 1st joint much longer than the other 6, subequal to peduncle, densely setose on front margin, accessory flagellum $\frac{3}{4}$ length of 1st flagellar joint, 2-jointed.

Second antenna lost.

Mandible stout, cutting-edge obtuse, 3rd joint of palp subequal to 1st and $\frac{1}{2}$ length of 2nd, tipped with 2 setae.

Maxilliped, outer plate with 9 stout, obtuse spines on inner margin.

First and second gnathopods similar to those of *S. serratus* (G. O. Sars).

Peraeopods 1-5 as in *S. walkeri* Bonn.

Uropods 1-3 as in *serratus*.

Length.—4 mm.

Colour.—In spirit, whitish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 1 ♂, 1 ovigerous ♀. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4526.)

Distinguished from the other species by the dorsal carination and postero-inferior angle of 3rd pleon segment.

AUSTROSYRRHOE n. g.

Like *Syrrhoe* Goës, but body dorsally carinate, gnathopod 1 stout, more robust than gnathopod 2, with the 5th joint broad, both gnathopods simple, side-plate 1 widened below and side-plate 4 almost as deep as 3.

Austrosyrrhoe crassipes n. sp.

(Plate XXXIV, fig. 11.)

♂. Body slender. Rostrum reaching nearly to end of 1st joint of 1st antenna, slightly deflexed. Eyes absent. Peraeon segments 5-7 slightly keeled, the keel on segment 7 with a quadrate, but not dentiform posterior angle. Side-plate 1 widened below, produced forwards subacutely, 3 widened below, antero-inferior angle acute, postero-inferior angle rounded, 4 nearly as deep as 3, rounded below. Pleon segments 1-4 slightly keeled, the keel on segments 1-3 ending in a short backwardly directed tooth, on 4 ending in a long slender spiniform tooth lying close to the dorsal surface of segment 5.

Telson elongate, cleft not quite half-way, apices acute.

First antenna, 1st and 2nd joints subequal, the upper apex of 2nd produced into a tooth, 3rd short, flagellum ca. 9-jointed, 1st longer than all the rest and subequal to the peduncle, strongly setose on anterior margin, accessory flagellum $\frac{2}{3}$ length of 1st flagellar joint, 2-jointed, the 1st long.

Second antenna longer than 1st, ultimate peduncular joint longer than penultimate, flagellum ca. 10-jointed.

Mouth-parts as figured by Sars for *Syrrhoe* (Crust. Norw., vol. i, pl. cxxxvi).

First gnathopod stout, 2nd joint 4 times as long as broad, distal anterior margin setose, 3rd and 4th nearly as wide as 2nd, 5th oval, twice as wide as 4th, inferior margin with ca. 12 pectinate spines, 6th $\frac{1}{2}$ width and length of 5th, inferior margin setulose distally, with a stout pectinate spine in the middle, 7th shorter than 6th, with denticle on inner margin.

Second gnathopod about equal to 1st in length, but much more slender, closely resembling that of *Bruzelia typica* Boeck, 5th joint subequal to 2nd, longer than 6th, which is setulose on distal inner margin, with a pectinate spine just proximal to the setules.

Peraeopods 1 and 2 slender.

Peraeopods 3-5 slender, 2nd joint oval, hind margin entire.

Uropods 1-3 as in *Syrrhoe crenulata* Goës.

Length.—4 mm.

Colour.—In spirit, whitish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 1 ♂. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4527.)

The character of the first gnathopod is quite unique in the family.

Gen. LEPECHINELLA Stebb.

1908. *Lepechinella*. Stebbing, J. Linn. Soc. Lond. Zool., vol. xxx, No. 198, p. 191.

1914. *Dorbanella*. Chevreux, Bull. Inst. océan. Monaco, No. 296, p. 1.

1924. „ Schellenberg, Mitt. Zool. Mus. Berlin, xi, 2, p. 205.

The fact that Stebbing placed his genus in the family *Paramphithoidae*, whereas Chevreux assigned his to the *Tironidae*, may account for the latter author overlooking Stebbing's genus, in spite of the highly characteristic dorsal processes.

The two forms clearly belong to the same genus, as may be seen by a comparison of the descriptions and figures of the mouth-parts, peraeopods, telson, and dorsal processes.

Stebbing's diagnosis holds good. Chevreux states that in *echinata* the "2nd and 3rd urosome segments" (pleon segments 5 and 6) are fused together, but this is not the case in *chrysotheras*.

Specifically, however, the two forms are easily distinguishable.

Chrysotheras Stebb. has no spines on the head besides the rostrum, a bifid 1st side-plate and a distinct palm on the 6th joint of the 1st and 2nd gnathopods; *echinata* (Chevr.), on the other hand, has an "interantennal tooth" on either side of the rostrum, the 1st side-plate with only a single pointed lobe, and scarcely any palm in the gnathopods. There are also differences in the length of the dorsal spines and the shape of the telson.

It is more difficult to decide in what family the genus should be ranged. Stebbing's decision would be quite satisfactory were it not for the presence of the well-defined inner lobes in the lower lip. For this reason it seems impossible to avoid placing the genus in the *Tironidae*. The two small deviations from the typical *Tironid* mouth-parts mentioned by Chevreux separate the genus equally from the *Paramphithoidae*. Perhaps later on a fusion of these two families may be thought desirable. Schellenberg places the genus in the neighbourhood of the *Atylidae*.

Up to the present *echinata* has only been found in the Gulf of Gascony, 46° 17' N., 5° 42' W., 4380 metres (Chevreux).

Lepechinella chrysotheras Stebb.

1908. *Lepechinella chrysotheras*. Stebbing, *loc. cit.*, p. 192, pl. xxvii.

Stebbing apparently had only the single specimen, and that was an immature one, 5-6 mm. long.

The present specimens agree with the original description and figures, except in the following details: posterior lobe of side-plates 3-6 less strongly developed, or even nearly obsolete, never acute, posterior angle of side-plate 7 also scarcely acute; postero-inferior angles of pleon segments 1-3 not always so acute or so much up-turned; telson slightly longer proportionately to its breadth than in Stebbing's figure, the lateral margins straight, with 3-6 setae; peduncle of 1st uropod with a strong spine on lower apex, as described by Chevreux in *echinata*, both rami with a row of regularly spaced spinules on inner margin.

The lower lip has well-developed inner lobes, which are, however, closely united nearly to their apices.

These characters are found in both sexes. There are, however, other characters which show sexual differences, namely, the 2nd antenna and 3rd uropod. In the ♀ these appendages resemble the young as figured by Stebbing. In the ♂ the 2nd antenna has a series of closely set tufts of short setules along the whole upper margin of

the 4th peduncular joint. The upper apex of the 3rd joint has a similar tuft.

The 3rd uropod, which in the ♀ scarcely exceeds the 2nd uropod, is considerably longer in the ♂, reaching as far back as the 1st uropod; the rami subequal or the outer a trifle longer than the inner, both margins of both rami fringed with rather long plumose setae.

Length.—8 mm.

Colour.—In spirit, yellowish-white.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms. Several ♂♂, ovigerous ♀♀, and juv. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4421.)

Geogr. Distribution.—59° 41' N., 3° W., 850 metres (Stebbing).

FAMILY EUSIRIDAE.

Gen. EUSIRUS Kröyer.

1845. *Eusirus*. Kröyer, *Naturn. Tidsskr.*, ser. 2, vol. i, pp. 501, 511.
 1888. „ Stebbing, *Challeng. Rep.*, vol. xxix, p. 964.
 1893. „ G. O. Sars, *Crust. Norw.*, vol. i, p. 415.
 1906. „ Stebbing, *Das Tierreich*, 21, pp. 338, 729.
 1907. „ Walker, *Nat. Ant. Exp.*, vol. iii, p. 30.
 1907. „ Chevreux, *Exp. Ant. Franc.*, p. 49.
 1911. „ *Id.*, *Ann. Mus. Nac. Buenos Aires*, ser. 3, vol. xiv, p. 405.
 1912. „ Stephensen, *Nath. Medd.*, vol. lxiv, p. 94.
 1912. „ Chilton, *Tr. Roy. Soc. Edin.*, vol. xlviii, pt. 2, p. 489.
 1913. „ Chevreux, *2me. Exp. Ant. Franc.*, p. 163.

Eusirus minutus G. O. Sars.

1893. *Eusirus minutus*. G. O. Sars, *loc. cit.*, p. 419, pl. cxlvii, fig. 2.
 1906. „ „ Stebbing, *loc. cit.*, p. 342.

Seven typical specimens calling for no remark.

Length.—5 mm.

Colour.—In spirit, pale pinkish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms, 1 ♂, 6 ♀♀. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4422.)

Geogr. Distribution.—Coast of Norway, 400 fathoms (Sars).

FAMILY GAMMARIDAE.

Gen. ELASMOPUS Costa.

Elasmopus spinimanus Wlkr.

1905. *Elasmopus spinimanus*. Walker, in Herdman's Ceylon Pearl Fish. Suppl. Rep., 17, p. 277, pl. v, fig. 36.

These specimens are very much larger than Walker's, and evidently represent the adult form. In general they agree with Walker's description.

Pleon segment 4 dorsally with a low rounded median longitudinal keel. The postero-inferior angle of pleon segment 3 has a minute acute point in the ♂, but this is obsolete in the ♀.

Telson with 3 spines in the apical notch of each lobe.

Accessory flagellum of 1st antenna 3-jointed.

First gnathopod in ♂, as described by Walker, but 6th joint not longer than 5th, upper margin of 5th and 6th with long setae, lower margin of 5th densely setose but the setae shorter; in ♀ similar, but without long setae on upper margin of 5th joint.

Second gnathopod in ♂, 6th joint of the same general shape as described by Walker, but the spinigerous tubercle at the finger-hinge is stronger than in his figures, being better described as a rounded lobe, the spines also are stronger, there are no spines posterior to the lobe, the whole lower margin as well as the inner surface of the hand being densely clothed with long minutely pectinate setae as in *E. brasiliensis* or *pectenicrus*; the finger closes within the spinigerous lobe and between the latter and a group of 3-4 short, stout spines, which are easily overlooked on account of the dense setose covering; in ♀ very like Walker's figure of the ♂, but without any projection near the hinge, there are 5-6 not very stout spines in this position, passing gradually into setae proximally, the proximal portion with fascicles of moderately long setae, setae on lower margin of 5th joint serrulate.

Uropod 3, the outer ramus is distinctly, though not greatly, longer than the inner.

Length.—14 mm.

Colour.—Indigo-purple, deeper dorsally, with numerous whitish or pale yellowish dots, the most conspicuous being a transverse row on the posterior margin of each pereon segment, a dorsal patch at the base of pleon segments 3 and 4 whitish, side-plates and 2nd joints of pereopods 3-5 paler, with the whitish dots less conspicuous, antennae

purple dotted with whitish, hand of 2nd gnathopod distally purplish, peraeopods and uropods banded with the same colour, telson light.

Locality.—Durban, 28/5/17 (H. W. Bell-Marley), 1 ♂, 1 ovigerous ♀. (S.A.M., No. A 4573.)

Geogr. Distribution.—Ceylon (Walker).

This species is closely allied to *pectenicrus* (of which *serrula* Wlkr. is a synonym), the chief resemblance being in the hand of the 2nd gnathopod in the ♂. This resemblance is so close that at first sight one might be tempted to regard the two forms as varieties of one species, the presence or absence of spines on the lobe near the finger-hinge being certainly not of specific importance.

But this feature is coupled with the difference in the hind margin of the 2nd joint of peraeopods 4 and 5, a difference which is found in both sexes: in *spinimanus* there are only slight serrations, whereas in *pectenicrus* there is a remarkable series of comb-like teeth.

Moreover, in the living animals there is the not unimportant feature of a different colour-pattern. By comparing the above description of the colour of *spinimanus* with that given for *pectenicrus* in a former paper (Barnard, *loc. cit.*, p. 199), it will be seen that in the latter the predominating or ground colour is white with purple markings, whereas in the former it is purple with white dots.

FAMILY TALITRIDAE.

Gen. PARHYALELLA Kunkel.

1910. *Parhyalella*. Kunkel, Tr. Conn. Ac. Sci., vol. xvi, p. 74.

Parhyalella natalensis (Stebb.).

1917. *Exhyalella natalensis*. Stebbing, Ann. Mag. Nat. Hist. (8), vol. xx, p. 435.

1918. „ „ *Id.*, Ann. Durban Mus., vol. ii, pt. 2, p. 67, pl. xi.

Up to the present this genus has contained only the single species *F. batesoni* Kunkel, an inhabitant of the Bermuda Islands.

Length.—♂ 10 mm., ♀ 13 mm.

Colour.—Ground-colour, pale yellow or ochraceous, closely reticulated and spotted with red, which may vary in tint from a brick-red to a crimson-red, antennae and hand of 2nd gnathopod tinged with the same colour, 2nd joint of peraeopods 3–5 spotted like the rest of body, the terminal joints of these 3 peraeopods, and of the uropods, white; eye blackish-brown.

Locality.—Durban, 28/5/17 (H. W. Bell-Marley), ♂♂, ovigerous ♀♀, and juv. Whether taken between tide-marks or at low-tide not stated by the collector. (S.A.M., No. A 4574.)

Easily distinguished from *batesoni* by the 1st and 2nd gnathopods, and the details of the antennae.

Gen. ORCHESTIA Leach.

- 1813–14. *Orchestia*. Leach, Edinb. Encycl., vol. vii, p. 402.
 1890. „ Sars, Crust. Norw., vol. i, p. 24.
 1906. „ Stebbing, Das Tierreich, 21, pp. 530, 735.
 1907. „ Chevreux, Mem. Soc. Zool. Fr., vol. xx, p. 491.
 1909. „ Chilton, Subantarctic Is., New Zealand,
 vol. ii, p. 632.

Orchestia excavata Chevr.

1902. *Orchestia excavata*. Chevreux, Bull. Mus. d'Hist. Nat. Paris,
 1902, No. 7, p. 521.
 1908. „ „ *Id.*, Res. Sci. Voy. en Afr. d'Edouard
 Foa, p. 570, fig. (redescribed).

“ *Male*.—Body strongly compressed. First two side-plates a little deeper than their segments. Fifth side-plate much longer than deep. Pleon segments 1–3 ending in a small acute point, posterior margin crenulate. Fifth segment projecting strongly over the 6th. Eyes large, oval. First antennae more or less injured in all the specimens. Second antennae scarcely equal to one-third length of body. Ultimate peduncular joint much longer than penultimate. Flagellum shorter than last two peduncular joints together, 13-jointed. First gnathopod almost as in the type species, *O. littorea* (Mont), but much more robust. Palm slightly concave. Finger as long as palm. Sixth joint of 2nd gnathopod oval, palm separated from the posterior margin only by a small notch. Finger strongly curved, much longer than palm. Peraeopods armed with numerous small spines. Posterior margin of 2nd joints of peraeopods 3–5 crenulate. Ramus of uropod 3 as long as peduncle. Telson slightly emarginate, armed with 12 unequal spines.

“ *Female*.—Second antennae a little shorter than those of male, flagellum only 12-jointed. Sixth joint of 1st gnathopod much shorter than 5th. Palm very small, strongly excavate. Finger 3 times as long as palm. Sixth joint of posterior gnathopod produced well beyond extremity of finger.

“ *Longeur*.—7 mm.

"Haute-Zambèze, without more precise locality." (Chevreux, 1902.)

Chevreux remarks that no other *Orchestia* has yet been found at so great a distance from the sea coast.

FAMILY PHOTIDAE.

? Gen. EURYSTHEUS Bate.

? *Eurystheus scissimanus* n. sp.

(Plate XXXIV, fig. 15.)

As there is, unfortunately, only one specimen of this form, and as it is in some respects defective, a brief description must suffice. From the character of the hand of the 2nd gnathopod it is, however, easily recognised.

The absence of the antennae and the ♀ leaves it uncertain whether this form should be assigned to *Eurystheus* or *Podoceropsis*.

Body slender. Head with antero-lateral angles quadrate and occupied by the rather large subtrigonal or subrotund eyes. Gnathopod 1 simple, 6th joint scarcely as large as 5th, both joints setose in the inferior margin.

Gnathopod 2, 5th joint short and triangular, 6th oblong, widest across the transverse palm, which has a deep and narrow incision in the middle, defining angle with a short but strong tooth, inferior margin setose, finger matching palm, its inner margin with a few fine serrations.

Second joint of posterior peraeopods with hind margin feebly serrate.

Telson apically subtruncate, with a spine at each postero-lateral angle.

Length.—4 mm.

Colour.—In spirit, pale pinkish, eyes reddish.

Locality.—Vasco da Gama (Cape Peninsula), N. 40° E., distant 13 miles, 120 fathoms, 1 specimen. S.S. "Pieter Faure," 4/5/00. (S.A.M., No. A 6042.)

FAMILY AMPITHOIDAE.

Gen. AMPITHOE Leach.

See 1916. Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3, p. 253.

Ampithoe africana n. sp.

Antero-lateral angles of head obtuse. Eyes subrotund. Side-plate 1 produced forwards. Postero-inferior angle of 3rd pleon

segment rounded-quadrate. Telson broader than long, with 2 setae at each lateral angle.

First antenna not reaching beyond end of 3rd peraeon segment, 2nd joint slightly shorter than 1st, 3rd $\frac{1}{2}$ length of 2nd, all with rather long apical setae, flagellum longer than peduncle, ca. 20-jointed, each joint with a distinct whorl of setae.

Second antenna equal to 1st in ♂, not quite so long in ♀, stout, ultimate peduncular joint not as long as penultimate, both joints in ♂ with a dense fringe of setae along lower margin, in ♀ with several tufts of setae but not so dense as in ♂, flagellum subequal to peduncle ca. 16-jointed, each joint with a whorl of setae which are more numerous on the lower than the upper surface, especially in ♂.

Inner plate of 1st maxilla very small, with 1 seta.

First gnathopod in ♂, 2nd and 3rd joints apically lobed, 5th shorter than 6th and a little wider than base of 6th, 6th ovate, widest at base, hind margin shorter than the oblique sinuous palm, which is convex distally and concave proximally, defining angle obtuse, with a stout spine, lower surface of 6th sparsely setose, finger matching palm, inner margin serrulate; in ♀ similar but smaller, hind margin subequal to palm, which is convex throughout, except for a small shallow indent where the palmar spine is situated.

Second gnathopod in ♂ larger than 1st, 2nd and 3rd joints apically lobed, 6th wider than and considerably longer than 5th, ovate-oblong, the slightly sinuous hind margin longer than the palm, which is oblique, straight or very slightly concave, defining angle obtuse (ca. 130°), with a short stout spine, palm and hind margin sparsely setose, finger slightly overlapping palm, inner margin serrulate; in ♀ similar but smaller, 6th more oval, hind margin only slightly longer than palm, which is slightly convex, defining angle obtuse with a moderately long spine.

Peraeopods 1 and 2 stout, 2nd joint twice as long as broad.

Peraeopods 3-5 stout, 6th joint with 3 very prominent outstanding spines on distal anterior margin, and a 4th recurved immediately before the finger-hinge.

Uropod 3 with 4 spines and a tuft of setae on distal margin, outer ramus longer than inner, with 2 hooked spines.

Length.—9 mm.

Colour.—Pinkish-red, closely speckled with a deeper tint, eyes deep crimson.

Locality.—East London (R. M. Lightfoot), 1 ♂, 3 ovigerous ♀♀. (S.A.M., No. A 4415.)

Judging from Bate's figure, this species bears considerable resemblance to *A. brasiliensis* Dana in the strongly setose antennae. Bate also represents some strong spines on the 5th and 6th joints of peraeopod 4, but the whole figure is very crude, and a comparison with the present specimens in this respect is impossible.

The 2nd gnathopod of the ♂ is very similar to that of the ♀ of *A. kergueleni* Stebb. (1888, Challeng. Rep., vol. xxix, pl. cxvii), but the ♀ of the present species has the palm of this gnathopod convex instead of concave.

EXAMPITHOE n. g.

Side-plates shallow, not deeper than long, 5 only a little deeper than 4. First antenna without accessory flagellum. Mandible with molar greatly reduced; palp very slender, 3rd joint shortest, tipped with 2 setae only. First maxilla with very stout palp, 2nd joint being ovate-lanceolate, not linear and curved. Maxilliped as in *Ampithoe*, but with a very stout spine-tooth on apex of inner plate. First gnathopod stouter, though shorter, than 2nd, both subchelate. First and 2nd peraeopods glandular. Third peraeopod not reverted, longer than 2nd. Peraeopods 3-5 with 6th joint apically expanded. Outer ramus of 3rd uropod with 2 hooks. Telson simple, not uncinat, lateral angles obsolete.

From the above diagnosis it will be seen that a new genus is unavoidably necessary. The mandibular palp is even more slender than in *Paragrubia* Chevr., 1901. The tooth on the inner plate of the maxilliped appears to be unique in the family, although in itself it is not a very important point.

Biancolina Della Valle, 1893, is closely allied in the shape of the side-plates and the length and non-reverted position of the 3rd peraeopod. The new genus, however, is easily separated by the 2nd antenna being almost as long as the 1st, and the stout gnathopods.

Exampithoe natalensis n. sp.

(Plate XXXIV, figs. 16, 17.)

Body rather slender, moderately compressed. Integument sparsely and shallowly pitted, the pits most numerous on the side-plates. Head equal in length to first 2 segments together. Eyes small, oval. Side-plate 1 rhomboidal, longer than deep, antero-inferior angle a little less than a right angle; 2 and 3 longer than deep, antero-inferior angles rounded; 4 almost as deep as long, otherwise similar to 2 and 3; 5 a little deeper than 4, but longer than deep, posterior lobe small,

the anterior one rounded below ; 6 and 7 very shallow, semicircular, 6 very slightly bilobed. Pleon segments 1-3 with postero-inferior angles rounded.

Telson semicircular, broader than long, lateral angles obsolete, apex with a few setae.

First antenna half length of body, 1st joint stouter and a little longer than 2nd, 3rd short, $\frac{1}{4}$ length of 2nd, flagellum ca. 28-jointed, each joint with an apical whorl of setae and a sensory filament on lower side.

Second antenna nearly as long as 1st, ultimate peduncular joint shorter than penultimate, flagellum about equal to peduncle, ca. 22-jointed.

Upper lip entire rounded, margin setulose.

Lower lip similar to Della Valle's figure of that of *Biancolina*.

Mandibles, cutting-edge 8-dentate in left, 10-dentate in right, teeth blunter in right, secondary cutting-edge in left 6-dentate, obsolete in right, spine-row with 4 slender spines in left, obsolete in right, molar much reduced, palp very slender, 2nd joint a little longer than 1st, 3rd $\frac{1}{2}$ length of 2nd, tipped with 2 fine setae, no setae on the other joints.

First maxilla, inner plate small, tipped with 1 seta, outer plate with 10 strong, minutely denticulate spines, palp stout, 2nd joint ovate-lanceolate, inner margin and apex setose, a few setae also on the outer margin.

Second maxilla, plates equal in length, but outer broader than inner, inner margin of inner and apices of both setose.

Maxilliped, inner plate with a large very stout spine-tooth on apex, outer plate reaching to middle of 3rd joint of palp, inner margin with ca. 13 unserrated spines, changing gradually into the apical setae.

First gnathopod, 2nd joint strongly lobed on anterior apex, 5th and 6th subequal in length, 6th with palm oblique, concave, longer than hind margin, defining angle rounded-quadrate, with a strong spine, a smaller spine at the finger-hinge, finger gently curved, closing within defining angle, lower margins of 4th-6th joints and the palm thickly clothed with very finely plumose setae.

Second gnathopod longer, but not quite as stout as 1st, 2nd joint apically lobed, 5th and 6th similar to those of 1st gnathopod but more elongate, palm only a little longer than hind margin of 6th, concave, defining about 160° , with a stout spine, finger as long as palm, lower margins of 4th-6th and the palm setose as in 1st gnathopod.

First and second peraeopods, 2nd joint ovate, twice as long as broad, glandular.

Third peraeopod longer than the preceding, not reverted, 2nd joint twice as long as broad, 4th longer than 5th, 6th longer than 4th, apically expanded, anterior margin with 4 spines, 2 spines at angle of palm and another curved one at finger-hinge, finger overlapping palm.

Fourth and fifth peraeopods longer, 2nd joint narrower than in 3rd peraeopod, but proportions of the 4th-6th joints as in that peraeopod, only more elongate, armature of spines also the same.

First uropod, peduncle longer than rami, which are subequal.

Second uropod, peduncle and inner ramus subequal, outer shorter.

Third uropod reaching a little beyond the others, stout, peduncle with apical whorl of setae and 1 spine on upper apical margin, inner ramus as long as broad, apically rounded, with 2 spines and some setae, outer ramus as long as and much wider than inner, with 2 apical recurved hooks, upper margin without setules.

Length.—14 mm.

Colour.—In spirit, pale yellowish-white, eyes black.

Locality.—Port Shepstone, Natal, September 1916 (H. C. Burnup), 1 specimen. (S.A.M., No. A 4192.)

FAMILY COROPHIIDAE.

Gen. SIPHONOE CETES Kröyer.

1845. *Siphonoecetes*. Kröyer, Naturh. Tidsskr., ser. 2, vol. i, pp. 481, 491.

1916. „ Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3, p. 269 (references).

Siphonoecetes dellavallei Stebb.

1893. *Siphonoecetes typicus* (part). Della Valle, F. u. Fl. Neapel, vol. xx, p. 358, pl. iv, figs. 11-13; pl. vii, figs. 23-28.

1899. „ *dellavallei*. Stebbing, Ann. Mag. Nat. Hist., ser. 7, vol. iii, pp. 241, 350.

1906. „ „ *Id.*, Das Tierreich, 21, p. 684.

Rather small specimens, differing in no other respects from Stebbing's diagnosis.

Length.—4 mm.

Colour.—In spirit, pale yellowish, eyes pale brown.

Locality.—From stomach of a White Stumpnose (*Chrysophrys globiceps*) caught in Table Bay, 1906 (Dr. J. D. F. Gilchrist), 10 specimens. (S.A.M., No. A 4366.)

Geogr. Distribution.—Bay of Naples, 10–20 metres. On fine sand, constructing free tubes (Stebbing).

Two other specimens, which, so far as their hardened condition allows of examination, do not seem separable from the above species, were taken in the shrimp trawl, Cape Point, N.E. $\frac{3}{4}$ N., distant 39 miles, 310–560 fathoms, 17/9/03. (S.A.M., No. A 5912.)

FAMILY PODOCERIDAE.

Gen. PODOCERUS Leach.

See Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3, p. 274.

In “Aus Namaland und Kalahari” (Jena, 1907), Dr. L. Schultze has given an interesting account, illustrated by a text-figure (p. 34), of the habits of a species of *Podocerus* inhabiting the shores of South-West Africa. The animals are 2 mm. long, with brown transverse bands across the back. They burrow in the soft mud, and build small upright tubes projecting about 4 mm. above the surface of the mud. These tubes are sometimes solitary, sometimes in groups; they are attached to some firm object in the mud, and are composed of grains of mud and sand, together with sponge spicules and Diatom tests.

The species has not yet been identified or described.

Podocerus brasiliensis (Dana).

- | | | |
|----------|---------------------------------|--|
| 1853–55. | <i>Platophium brasiliense</i> . | Dana, U.S. Expl. Exp., vol. xiii, 2, p. 838, pl. lv, figs. 9a–l. |
| 1904. | „ <i>synaptochir</i> . | Walker in Herdman's Ceylon Pearl Fish. Suppl. Rep., 17, p. 296, pl. viii, fig. 52. |
| 1916. | <i>Podocerus</i> „ | Barnard, <i>loc. cit.</i> , p. 279. |
| 1917. | „ <i>brasiliensis</i> . | Stebbing, Ann. Durban Mus., vol. i, pt. 5, p. 447. |

Since the publication of my paper, in which the Durban specimens were identified with Walker's *synaptochir*, my friend Mr. F. W. Edwards of the British Museum has sent me tracings of Dana's

figures. From a comparison of the figures, it is evident that Walker's name must become a synonym of Dana's.

Geogr. Distribution.—Tropical Atlantic.

Podocerus africanus Brnrd.

1916. *Podocerus africanus*. Barnard, *loc. cit.*, p. 278, pl. xxviii, figs. 24, 25.

Since describing this species very briefly, I have seen tracings of Dana's figures of *brasiliensis*, and find that it is very much more distinct from this latter species than I formerly thought.

Apart from the 2nd joints of the peraeopods, both gnathopods in both sexes show well-marked differentiating features. In gnathopod 1 the 5th joint is as long as the 6th, the latter more broadly oval. In gnathopod 2 both sexes lack the bundles of spines on the front margin of the hand, and there is only a small stretch of *short* plumose setae on the palm in the ♂ around the 2 teeth. The finger meets the acute process of 4th joint, thus forming a kind of chela. This latter feature clearly distinguishes this species from both *variegatus* Leach and *brasiliensis* (Dana).

The Natal specimens agree in structural details with the Cape specimens, but are a trifle larger and more robustly built. Thus the 2nd antenna in both sexes is stouter, and in the ♂ possesses a dense fringe of setae on the lower margins of 4th and 5th peduncular joints and 1st flagellar joint.

Also the 2nd gnathopod in the ♂ is more strongly developed; 4th joint very strongly produced, front and hind margins of 6th parallel, the latter therefore concave, with the 2 palmar teeth near the hinge, but without any fringe of hairs.

Length.—6 mm.

Colour.—In spirit, dull pinkish with minute black pigment specks.

Locality.—Port Shepstone, Natal, September 1916 (H. C. Burnup), 2 ♂♂, 2 ovigerous ♀♀. (S.A.M., No. A 4193.)

Podocerus multispinis n. sp.

(Plate XXXIV, fig. 18.)

♂ and *juv.*—Head with a blunt median point and rounded antero-lateral angles, in which the prominent eyes are situated; a median spiniform tubercle somewhat behind the level of the eyes.

Peraeon broad and elliptical in both sexes, not keeled, with spiniform

tubercles arranged as follows: a transverse row of 3 on both the anterior and posterior margins of segment 1, a single transverse row of 3 on the posterior margins of segments 2-7, those on the last segment larger than the preceding. These spines project straight upwards, though the anterior and posterior ones curve a little respectively forwards and backwards. In the young they are shorter and less spiniform. No other projections on the peraeon; the lateral margins produced slightly over the insertions of the side-plates, but not thickened. Side-plate 1 produced forwards nearly to the level of the eye, inferior margin entire; side-plates 2-4 notched on inferior margin; 5 and 6 with the anterior lobe much deeper than the posterior; 7 produced backwards in a bluntly rounded lobe. All the side-plates with stiff outstanding setae.

Pleon segments 1 and 2 both with a transverse row of 3 spines on posterior margin; segment 3 and the following ones smooth.

Telson apically rounded, with 2-3 setae on the dorsal projection.

First antenna, 2nd and 3rd joints subequal, flagellum 8-jointed, the 1st joint much the longest, accessory flagellum 1-jointed, equal to $\frac{1}{3}$ 1st joint of flagellum; flagellum and peduncle fringed on lower surface with long setae.

Second antenna longer than 1st, ultimate joint longer than penultimate, flagellum equal to penultimate peduncular joint, 3-jointed, the joints successively decreasing in length.

Mandible with 3rd joint of palp longer than 1st, but shorter than 2nd, twice as long as broad. Other mouth-parts without particular features.

First gnathopod in ♂, 2nd, 5th, and 6th joints subequal to one another, 6th broader than 5th, increasing in width to the transverse palm, defining angle rounded-quadrate with a spine, lower margins of 4th-6th joints, the palm and the inner surface of 6th with long setae, finger matching palm.

Second gnathopod in ♂, 2nd joint strongly keeled on both inner and outer margins, both keels ending apically in a rounded setiferous lobe; when the limb is flexed the 5th joint rests within these keels; 3rd very slightly keeled on the same margins as in 2nd, 4th apically rounded, 5th small but distinct from 6th, which is elongate oval, palm $\frac{2}{3}$ length of the joint, forming the lower margin but defined by a strong conical tooth, a square-topped tooth near the finger-hinge, and between this and the defining tooth a conical, obscurely bifid tooth, inferior margins of 4th and 6th joints rather densely setose, anterior margin of 6th with tufts of setae, finger not quite as long as palm. In immature speci-

mens the 6th joint is less elongate, the defining tooth not so strong, and the oblique, convex palm with 2 little indents.

Peraeopods 1 and 2, 2nd joint twice as long as broad, anterior margin fringed with long setae.

Peraeopods 3-5, 2nd joint becoming successively stouter, in 5th peraeopod half as long as broad.

All the peraeopods rather strongly setose.

Uropods 1 and 2, inner ramus longer than outer, inner margin of peduncle and of inner ramus with a row of closely set spines like a comb.

Uropod 3 scarcely as long as peduncle of 2nd, with 1-2 setae on rounded apex.

Length.—10 mm.

Colour.—In spirit, yellowish-white, eyes slightly darker.

Locality.—Cape St. Francis, N.E. by E. $\frac{1}{2}$ E., distant 36 miles, 70 fathoms, 1 ♂, 3 juv. on a club-shaped siliceous sponge; Constable Hill, N.N.E., distant 7 miles (near Saldanha Bay), 45 fathoms, 2 ♂♂, 9 juv. on and inside a tubular *Leuconia*-like sponge. S.S. "Pieter Faure," 19/2/02 and 11/3/02. (S.A.M., Nos. A 4416 and A 4417.)

This species is easily recognised by the ornamentation of the body, the 2nd gnathopod, and the row of closely set spines on the 1st and 2nd uropods.

Podocerus multispinis var. *levis* n.

Body oval, broader in ♀ than ♂. Head smooth, with the exception of a tiny acute tubercle between the eyes, scarcely visible in the ♀. Peraeon segments 1-3 transversely grooved. From about the 4th segment a very slight medio-dorsal keel begins, extending on to 3rd pleon segment, and produced on the posterior margins of segments 5-7 into a small backwardly projecting acute tooth. On pleon segment 1 there is a similar tooth, but on segments 2 and 3 the keel is merely rounded in profile. These teeth are present in the ♀ also, but even less prominent than in ♂.

The side-plates are not joined directly on to the lateral margins of the segments, but just below, so that the lateral margins project freely and give the appearance of there being two series of side-plates; their postero-lateral angles are bluntly pointed. The side-plates are shallow, the 1st acutely produced forwards, 2nd-4th with a notch on inferior margin, 5th with the anterior lobe twice as deep as the posterior; margins of each side-plate with stiff outstanding setae.

Telson with 2 setae on the moderately prominent dorsal conical process.

First antenna about $\frac{1}{2}$ length of body, 2nd joint slightly longer than 3rd, flagellum slightly longer than 2nd, ca. 9-jointed, accessory flagellum 1-jointed, lower margin of whole antenna fringed with long setae in both sexes.

Second antenna as long as body, ultimate peduncular joint slightly longer than penultimate, flagellum $\frac{2}{3}$ length of ultimate joint, 3-jointed, with a minute apical 4th joint.

Mouth-parts normal.

First gnathopod in ♂, 2nd joint slightly expanded on distal front margin, 5th equal to 2nd and longer than 6th, which is ovoid, hind margin slightly longer than the minutely crenulate palm, finger stout, with spinules on inner distal margin; in ♀ smaller, but otherwise similar.

Second gnathopod in ♂, 2nd joint stout, strongly expanded on both inner and outer anterior margins, distal anterior angles rounded, setiferous, 4th not produced, bluntly rounded distally, 6th broadly oval, palm about twice length of hind margin, defined by a strong conical tooth, near the finger-hinge a denticulated lobe followed by a conical tooth, lower margins of 4th and 6th with dense fringe of plumose setae, front margin of 6th with groups of setae, finger curved, not reaching defining tooth; in ♀ of the same general shape, but smaller, 2nd joint not so expanded on front margins, 4th apically bluntly rounded, 6th with the same armature on the palm, but not so well developed, fringe of setae on 4th and 6th sparse, front margin of 6th with groups of setae.

Peraeopods 1-5 furnished with rather numerous stiff, outstanding setae, 2nd joint oval-oblong, not strongly expanded.

Uropods 1 and 2, inner ramus longer than outer, inner margins of peduncle and inner ramus with numerous close-set spines.

Uropod 3 elongate-ovoid, with apical setae.

Length.—♂ 7 mm., ♀ 5 mm.; *breadth*, ♂ and ♀, 2 mm.

Colour.—In spirit, yellowish, eyes slightly deeper.

Locality.—Exact locality not recorded. Several ♂♂ and ovigerous ♀♀ on a branching Halichondrine sponge. S.S. "Pieter Faure." (S.A.M., No. A 4386.)

Although at first sight quite distinct from the typical *multispinis*, the only real difference separating the two forms is the almost complete absence of the dorsal spiniform tubercles in the variety. This cannot be regarded as of specific importance in the face of such a close

agreement as is found in the appendages and side-plates. Moreover, it is quite possible that intermediate forms exist which have not yet been discovered. For the present a varietal name seems justifiable. The description of the variety has been left exactly as it stood in my MSS. some while before the typical specimens were found amongst the "Pieter Faure" collections. The two descriptions, written thus quite independently of one another, will show how much alike the two forms are.

TRIBE CYAMIDEA.

FAMILY CAPRELLIDAE.

Gen. CAPRELLA Lam.

See 1916. Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3, p. 280.

Caprella scaura Templeton.

1836. *Caprella scaura*. Templeton, Tr. Entom. Soc. Lond., vol. i, pt. 3, p. 191, pl. xx, fig. 6.
 1836. „ *nodosa*. *Id.*, *ibid.*, p. 192, pl. xx, fig. 7 (juv.).
 1852. „ *attenuata*. Dana, U.S. Expl. Exp., vol. xiii, pt. 2, p. 817, pl. liv, figs. 1a-g.
 ?1855. „ *solitaria*. Stimpson, Pr. Ac. Nat. Sci. Philad., vol. ii, p. 393.
 1882. „ *scaura*. Mayer, Caprelliden, F. u. Fl. Neapel, p. 65.
 1888. „ „ Stebbing, Challeng. Rep., vol. xxix, p. 1257, pl. cxliv (♀).
 1890. „ „ Mayer, Nachtrag Caprelliden, F. u. Fl. Neapel, p. 70, pl. iv, figs. 40-51; pl. vi, fig. 41; pl. vii, figs. 2, 35, 36.
 1903. „ „ *Id.*, Siboga Exp. monogr., 34, p. 117, pl. v, figs. 13-18; pl. x, fig. 11.
 1903. „ *laevipes*. *Id.*, *ibid.*, p. 108, pl. v, fig. 2; pl. viii, figs. 14-16.

Two male specimens and one young one are referable to this species. The tooth on the head is strong. Segments 3-5 each with a pair of small subdorsal tubercles, segment 6 with a single median one. In the young specimen only the latter single tubercle is present. No ventral spine between bases of the 2nd gnathopods.

Flagellum of 1st antenna 14-jointed.

Second gnathopod with the hand most resembling Mayer's figure 47 on pl. iv of his "Nachtrag."

The head plus 1st segment and the 2nd segment are neither very elongate, scarcely longer than the 3rd segment.

Length.—11 mm.

Colour.—In spirit, dull pinkish, eyes darker.

Locality.—Off Malagass Island (Saldanha Bay), 20 fathoms, 2 ♂♂, 1 juv. on a Sea-urchin. S.S. "Pieter Faure," 13/3/02. (S.A.M., No. A 4395.)

Geogr. Distribution.—Mauritius (Templeton, *scaura* and *nodosa*); Rio Janeiro (Dana, *attenuata*); Japan, 50 fathoms (Stebbing); Japan and China Sea, 25–80 fathoms; California, 1–15 fathoms; W. Indies, Chile (Mayer); Port Natal and Kalk Bay (Mayer, *laevipes*).

Although Mayer states that Stimpson's *solitaria* is quite unrecognisable, I think there is great probability of its belonging here. The present species is the only Cape Caprellid which has a strong cephalic tooth; but, on the other hand, Stimpson describes the 2nd gnathopod as having only "2 spines within," which does not quite agree with *scaura*.

With regard to *laevipes*, although it forms a very distinct dwarf variety, it cannot in my opinion be separated from the larger forms. Mayer himself notes the resemblance of the 2nd gnathopod to that of *scaura*; and one has only to compare figures 2 and 18 on pl. v of his Siboga monograph to feel convinced that *laevipes* should not be raised to specific rank. Besides its small size, it is characterised by not having the anterior segments specially elongate in the ♂, a feature which it shares with the 2 ♂♂ above described, and which are undoubtedly examples of *scaura*.

Gen. ORTHOPROTELLA Mayer.

1903. *Orthoprotella*. Mayer, Siboga Exp. monogr., 34, p. 35.

Orthoprotella mayeri Brnrd.

1903. *Orthoprotella* sp. Mayer, *loc. cit.*, p. 36, pl. i, figs. 25, 26; pl. vi, figs. 43, 44, 46; pl. ix, fig. 15.

1916. „ *mayeri*. Barnard, Ann. S. Afr. Mus., vol. xv, pt. 3, p. 284.

Further specimens have come to light, which enable me to give some account of the variability in the ornamentation.

Young specimens up to 8 or 10 mm. are quite smooth, after which

the spines begin to develop. When well-developed there is a lateral spine on the anterior margin of segment 2 and another above the base of 2nd gnathopod, also a dorsal pair inclined somewhat forwards. On segment 3 there is a similar antero-lateral spine and a pair of dorsal tubercles, always low and blunt and frequently obsolete.

Some, or even, in the case of one ♂ specimen 14 mm. long, all of these spines and tubercles may be very feebly developed, the greatest development not necessarily occurring in the largest specimens. In the present collection the ♀♀ are more strongly spinose than the ♂♂.

The 4th segment may also exceptionally have 2 very small dorsal tubercles.

Segments 1, 2, and 3, but more often 2 and 3 only, have the posterior portion raised into a medio-dorsal keel, which, however, is never apically acute or tooth-like.

One of the specimens was stated in my original description to have a single dorsal spine on segment 2; on re-examination I find that its fellow had been broken off.

The 2nd gnathopod of the ♀ is similar to that of the ♂ and is almost equally strongly developed. The notch, which in my previous description was stated to lie between the venom-tooth and the inferior margin, in reality lies between the tooth and the *palm*.

Peraeopod 3 slender. Peraeopods 4 and 5 moderately stout, 6th joint elongate, palm slightly concave, with 2 spines at proximal end.

Length.—♂ up to 20 mm., ♀ up to 14 mm.

Colour.—In spirit, dull pinkish or yellowish, eyes red-brown.

Locality.—Algoa Bay, 100 fathoms, 1 ♀, 1 juv. on *Melitodes*; Cove Rock, N.W. $\frac{3}{4}$ W., distant 13 miles, 80–130 fathoms, 2 ♀♀, 1 juv. on the Alcyonarian *Ceratoisus ramosus*; Cape St. Francis, N.E. by E., distant 32 miles, 74 fathoms, 2 ♂♂, 2 ♀♀; Cape Seal, N. by E. $\frac{3}{4}$ E., distant 37 miles, 80 fathoms, 2 ♂♂, 4 juv.; Cape Point, N. 16 E., distant 10 miles, 85 fathoms, 1 ♂. S.S. "Pieter Faure," 1/11/98, 30/7/01, 19/2/02, 20/2/02, and 5/9/02. (S.A.M., Nos. A 4398–A 4402.)

TRIBE PHRONIMIDEA.

FAMILY HYPERIIDAE.

Gen. EUTHEMISTO BOV.

1825. *Themisto*. Guérin, Encycl. Méth., t. 10 (nom. preocc.).

1887. *Euthemisto*. Bovallius, Bih. K. Sv. Vet. Ak. Handl., Bd. 11, No. 16, p. 21.

1888. *Euthemisto*. Stebbing, Challeng. Rep., vol. xxix, p. 1407.
 1889. „ Bovallius, K. Sv. Vet. Ak. Handl., Bd. 22, No. 7, p. 299.

Euthemisto gaudichaudii (Guérin).

1828. *Themisto gaudichaudii*. Guérin, Mém. Soc. d'Hist. Nat. Paris, vol. iv, pl. xxiii.
 1879. „ *antarctica*. Thomson, Tr. N. Zeal. Inst., vol. ii, p. 243, pl. x, D, figs. 2, 3 (non Dana).
 1888. *Euthemisto gaudichaudii*. Stebbing, loc. cit., p. 1410, pls. clxxii, clxxiii.
 1888. „ *thomsoni*. Id., loc. cit., p. 1414, pls. clxxiv, clxxv.
 1889. „ *gaudichaudii*. Bovallius, loc. cit., p. 299, pl. xiii, figs. 44–46.
 1901. „ *compressa*. Vosseler, Plankton Exp., vol. ii, G. e., p. 81.
 1907. „ *gaudichaudii*. Walker, Nat. Ant. Exp., vol. iii, p. 9.
 1910. „ *thomsoni*. Stebbing, Sci. Res. "Thetis," pt. 12, p. 655.
 1912. „ „ Chilton, Tr. Roy. Soc. Edin., vol. xlviii, pt. 2, p. 514.

As Stebbing (1910) remarks, Vosseler and Bovallius are not quite in agreement as to the synonymy, except in refusing *thomsoni* specific validity. Whether *gaudichaudii* should be united with *compressa* or *spinosa* remains an open question until more abundant material is available.

Both specimens are non-ovigerous ♀♀, and have the head shorter than the first 3 peraeon segments together, the peraeon about equal to the pleon, uropod 1 reaching almost to apex of 2nd, and the telson $\frac{1}{4}$ length of peduncle of 3rd uropod.

Length (to end of 3rd uropod).—13 mm.

Colour.—Dull red.

Locality.—Cape Town Harbour, 1 specimen entangled in Hydroids, etc., growing on the harbour boom, 10/5/18 (R. W. E. Tucker); Lion's Head, S.E., 22 miles, 95 fathoms. 1 specimen. S.S. "Pieter Faure." (S.A.M., Nos. A 5914 and A 5972.)

Geogr. Distribution.—Southern Atlantic, Indian and Pacific Oceans, Antarctic.

FAMILY PHROSINIDAE.

Gen. PRIMNO Guér-Mén.

1836. *Primno*. Guérin-Ménéville, Mag. de Zool., tom. 6, classe 7, p. 2.

1888. „ Stebbing, Challeng. Rep., vol. xxix, p. 1440
(references).

Primno macropa Guér-Mén.

1836. *Primno macropa*. Guérin-Ménéville, *loc. cit.*, p. 4, pl. xvii,
figs. 1a-f.

1862. „ „ Bate, Cat. Amph. Brit. Mus., p. 322, pl.
li, fig. 8.

1888. „ „ Stebbing, *loc. cit.*, p. 1441, pl. clxxviii
(references).

The 5th joint of peraeopod 3 has 3 small teeth between the 4th and 5th long teeth, instead of 2, but otherwise there is no difference from Stebbing's figures and description.

Length.—8 mm.

Colour.—In spirit, semi-transparent, muscles and eyes dull pinkish.

Locality.—Cape Point, N. 89° E., distant 36 miles, 700 fathoms,
1 ovigerous ♀. S.S. "Pieter Faure," 20/8/03. (S.A.M., No. A 4420.)

Geogr. Distribution.—Chile (Guérin), 36° 32' S., 132° 52' W., South Pacific (Stebbing).

FAMILY VIBILIIDAE.

1910. *Vibiliidae*. Stebbing, Gen. Cat. S.A. Crust., p. 474.

1912. „ Behning, Zoologica, vol. lxvii, p. 211 (revision).

Gen. VIBILIA M. Edw.

1830. *Vibilia*. M. Edwards, Ann. Sci. Nat., vol. xx, p. 386.

1887. „ Bovallius, K. Sv. Vet. Ak. Handl., vol. xxi, No. 5,
p. 43.

1910. „ Stebbing, *loc. cit.*, p. 474.

1913. „ Stewart, Ann. Mag. Nat. Hist., ser. 8, vol. xii,
p. 246.

1918. „ Stephensen, Rep. Dan. Oceanogr. Exp., vol. ii,
D. 2, p. 33.

Vibilia armata Bov.

1887. *Vibilia armata*. Bovallius, Bih. K. Sv. Vet. Ak. Handl.,
Bd. xi, No. 16, p. 10.

1887. „ „ *Id.*, *loc. cit.*, p. 69, pl. x, figs. 15-22.

1901. *Vibilia armata*. Vosseler, Plankton Exp., vol. ii, G. e., p. 125.
 1903. " " Walker, Ann. Mag. Nat. Hist., ser. 7, vol. xii, p. 232.
 1904. " " Stebbing, Tr. Linn. Soc. Lond. Zool., vol. x, pt. 2, p. 31.
 1906. " " Tattersall, Fish. Irel. Sci. Inv., 1905, vol. iv, p. 15.
 1911. " " Sexton, J. Mar. Biol. Ass., vol. ix, pt. 2, p. 222.
 1913. " " Stewart, *loc. cit.*, p. 250.
 1918. " " Stephensen, *loc. cit.*, p. 46, figs. 15, 16.

A single ♂ specimen agreeing with Bovallius' description and figures except in one particular. The eyes are very much larger, being about as large as in *V. macropis* Bov. (*loc. cit.*, pl. viii, fig. 1), but composed of considerably fewer ommatidia than in the latter species.

Terminal joints of the 1st antenna quite obsolete; 2nd antenna 8-jointed.

Length.—7 mm.

Colour.—In spirit, dull pinkish, eyes deep red-brown.

Locality.—Lion's Head (Cape Town), S.E. $\frac{1}{4}$ E., distant 50 miles, 250 fathoms, 1 ♂. S.S. "Pieter Faure," 2/4/02. (S.A.M., No. A 4392.)

Geogr. Distribution.—Tropical and South Atlantic (Bovallius); Bay of Biscay, 0–50 fathoms (Stebbing and Sexton); North Atlantic, 510–790 fathoms (Walker); West Coast of Ireland, 30–750 fathoms (Tattersall); $36^{\circ} 3\frac{1}{4}'$ S., $12^{\circ} 50\frac{1}{4}'$ E., and $35^{\circ} 14\frac{1}{4}'$ S., $15^{\circ} 11\frac{3}{4}'$ E. (Stewart); a long list of stations in Mediterranean and Atlantic is given by Stephensen.

Miss Stewart adds in brackets after the last locality, "near Tristan da Cunha." It is, however, much nearer to the Cape than to that island.

Vibilia hodgsoni Stewart.

1913. *Vibilia hodgsoni*. Stewart, *loc. cit.*, p. 251, pl. vi, figs. 1–6.

Locality.— $36^{\circ} 3\frac{1}{4}'$ S., $12^{\circ} 50\frac{1}{4}'$ E. (Stewart).

Vibilia gracilentia Bov.

1887. *Vibilia gracilentia*. Bovallius, *loc. cit.*, p. 67, pl. x, figs. 1–14.
 1901. " " Vosseler, Plankton Exp., vol. ii, G. e., p. 125.

1909. *Vibilia gracilentia*. Walker, Tr. Linn. Soc. Lond. Zool.,
vol. xiii, pt. 1, p. 53.

1913. „ „ Stewart, *loc. cit.*, p. 250.

Locality.— $35^{\circ} 14\frac{1}{4}'$ S., $15^{\circ} 11\frac{1}{4}'$ E. (Stewart).

Geogr. Distribution.—Atlantic (Bovallius); Gulf of Florida, N. and S. Equatorial currents (Vosseler); Indian Ocean, 200–600 fathoms (Walker).

This species is included under *V. armata* by Stephensen, 1918.

INDEX.

A	PAGE	E	PAGE
<i>abyssorum</i> (<i>Orchomene</i>)	330	Elasmopus	358
<i>Aceroides</i>	349	Eurystheus	361
<i>Acidostoma</i>	322	EUSIRIDAE	357
<i>adversicola</i> (<i>Lakota</i>)	327	Eusirus	357
<i>africana</i> (<i>Ampithoe</i>)	361	Euthemisto	373
<i>africanus</i> (<i>Podocerus</i>)	367	Exampithoe (<i>Ampithoidae</i>)	363
<i>algoense</i> (<i>Phoxostoma</i>)	323	excavata (<i>Ampelisca</i>)	336
<i>Amaryllis</i>	324	excavata (<i>Harpinia</i>)	340
<i>Ampelisca</i>	335	excavata (<i>Orchestia</i>)	360
AMPELISCIDAE	335	<i>Exhyalella</i>	359
AMPHILOCHIDAE	341	<i>Exunguia</i>	346
<i>Amphilochus</i>	342		
<i>Ampithoe</i>	361	G	
AMPITHOIDAE	361	<i>gallensis</i> (<i>Stenothoe</i>)	344
<i>anacantha</i> (<i>Halice</i>)	347	GAMMARIDAE	358
<i>Anonyx</i>	322, 330	GAMMARIDEA	320
<i>antarctica</i> (<i>Themisto</i>)	374	<i>gaudichaudii</i> (<i>Euthemisto</i>)	374
<i>armata</i> (<i>Vibilia</i>)	375	<i>Gitanopsis</i>	341
<i>assimilis</i> (<i>Stenothoe</i>)	345	<i>gracilentia</i> (<i>Vibilia</i>)	376
<i>attenuata</i> (<i>Caprella</i>)	371		
<i>Austrosyrrhoe</i> (<i>Tironidae</i>)	354	H	
		<i>Halice</i>	347
B		<i>Harpinia</i>	340
<i>brasilensis</i> (<i>Podocerus</i>)	366	HAUSTORIIDAE	338
<i>byblisoides</i> (<i>Ampelisca</i>)	335	<i>hodgsoni</i> (<i>Vibilia</i>)	376
		HYPERIIDAE	373
C			
<i>capensis</i> (<i>Platyschnopus</i>)	338	I	
<i>Caprella</i>	371	<i>induratus</i> (<i>Uristes</i>)	333
CAPRELLIDAE	371		
<i>carimanus</i> (<i>Orchomene</i>)	330	L	
<i>Cheirimedon</i>	325	<i>laevipes</i> (<i>Caprella</i>)	371
<i>chilensis</i> (<i>Orchomenopsis</i>)	330	<i>Lakota</i>	327
<i>chrysotheras</i> (<i>Lepechinella</i>)	356	<i>Lepechinella</i>	355
COLOMASTIGAE	346	<i>Leucothoe</i>	342
<i>Colomastix</i>	346	LEUCOTHOIDAE	342
<i>compressa</i> (<i>Euthemisto</i>)	374	<i>levis</i> (<i>Podocerus multispinis</i> var.)	369
<i>conocephalus</i> (<i>Amaryllis</i>)	324	<i>limicola</i> (<i>Aceroides</i>)	350
COROPHIIDAE	365	<i>longimanus</i> (<i>Perioculodes</i>)	352
<i>crassimanus</i> (<i>Colomastix</i>)	346	LYSIANNASIDAE	320
<i>crassipes</i> (<i>Austrosyrrhoe</i>)	354		
<i>Cratippus</i>	346	M	
<i>ctenochir</i> (<i>Leucothoe</i>)	342	<i>macropa</i> (<i>Primno</i>)	375
CYAMIDEA	371	<i>mayeri</i> (<i>Orthoprotella</i>)	372
<i>Cyproidea</i>	341	<i>minutus</i> (<i>Eusirus</i>)	357
		<i>mirabilis</i> (<i>Platyschnopus</i>)	338
D		<i>Monoculodes</i>	352
<i>dellavallei</i> (<i>Siphonocetes</i>)	365	<i>multispinis</i> (<i>Podocerus</i>)	367
<i>dolichoceras</i> (<i>Leucothoe</i>)	343	<i>musculosus</i> (<i>Orchomene</i>)	330
<i>Dorbanella</i>	355		

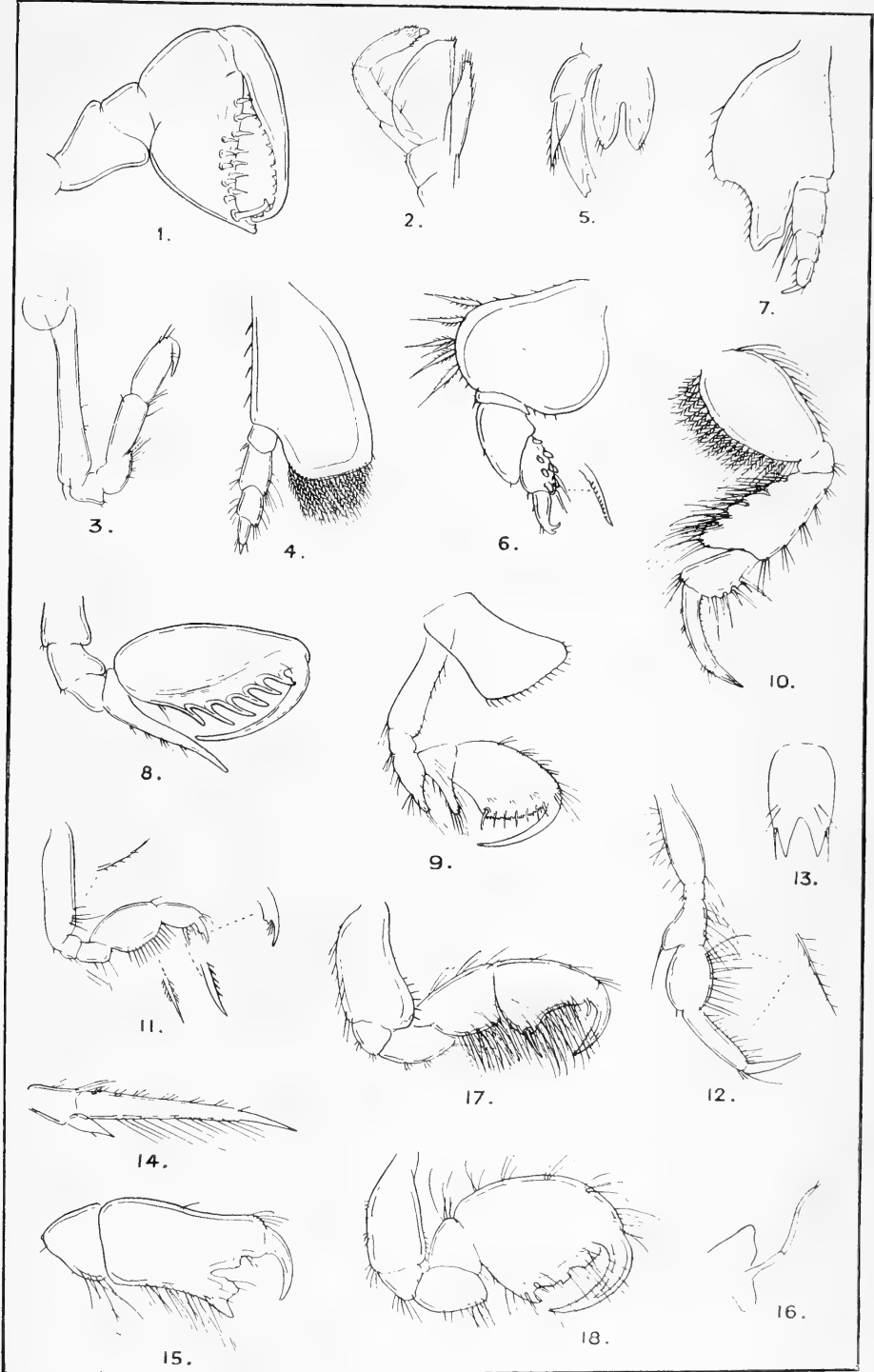
Contributions to the Crustacean Fauna of South Africa. 379

N	PAGE	R	PAGE
natalensis (Exampithoe) . . .	363	remipes (Trischizostoma) . . .	321
natalensis (Parhyalella) . . .	359	rossi (Orchomenopsis) . . .	330
neapolitanus (Amphilochus) . . .	342	rotundatus (Lakota) . . .	329
nodosa (Caprella) . . .	371		
O		S	
obesum (Acidostoma) . . .	322	scaura (Caprella) . . .	371
obtusa (Orchomenopsis) . . .	330	scissimanus (Eurystheus) . . .	361
Oediceroides . . .	348	serratum (Trischizostoma) . . .	320
Oedicros . . .	352	Siphonocetes . . .	365
OEDICEROTIDAE . . .	348	solitaria (Caprella) . . .	371
Orchestia . . .	360	spinimanus (Elasmopus) . . .	358
Orchomenopsis . . .	330	Stenothoe . . .	344
ornata (Cyproidea) . . .	341	STENOTHOIDAE . . .	344
Orthoprotella . . .	372	synaptochir (Podocerus) . . .	366
		Synchelidium . . .	352
P		Syrrhoites . . .	353
PARDALISCIDAE . . .	347	T	
Parhyalella . . .	359	TALITRIDAE . . .	359
paucispinosum (Trischizostoma) . . .	320	tenellus (Syrrhoites) . . .	353
pectinipalma (Cheirimedon) . . .	325	tenuimanum (Synchelidium) . . .	352
Periocolodes . . .	351	Themisto . . .	373
PHOTIDAE . . .	361	thomsoni (Euthemisto) . . .	374
PHOXOCEPHALIDAE . . .	340	TIRONIDAE . . .	353
Phoxostoma (Lysiannasidae) . . .	323	Trischizostoma . . .	320
PHRONIMIDÆA . . .	373	typicus (Siphonocetes) . . .	365
PHROSINIDAE . . .	375		
Platyischnopus . . .	338	U	
plumicornis (Oediceroides) . . .	348	Uristes . . .	333
PODOCERIDAE . . .	366		
Podocerus . . .	366	V	
Primno . . .	375	valida (Stenothoe) . . .	344
proxima (Orchomenopsis) . . .	330	Vibilia . . .	375
pusilla (Colonastix) . . .	346	VIBILIIDAE . . .	375
pusilla (Gitanopsis) . . .	341		

EXPLANATION OF PLATE.

FIG.

1. *Trischizostoma serratum* n. sp. 1st gnathopod.
2. *Phoxostoma algoense* n. g. et sp. Maxilliped.
3. *Uristes induratus* n. sp. 1st gnathopod.
4. *Ampelisca byblisoides* n. sp. 5th peraeopod.
5. „ *excavata* n. sp. Telson and 3rd uropod.
6. „ „ 4th peraeopod.
7. „ „ 5th peraeopod.
8. *Leucothoe ctenochir* n. sp. 2nd gnathopod.
9. *Aceroides limicola* n. sp. 1st gnathopod.
10. „ „ 3rd peraeopod.
11. *Austrosyrrhoe crassipes* n. g. et sp. 1st gnathopod.
12. *Halice anacantha* n. sp. 1st peraeopod.
13. *Platyischnopus capensis* n. sp. Telson.
14. „ „ 3rd uropod.
15. *Eurystheus scissimanus* n. sp. 2nd gnathopod.
16. *Exampithoe natalensis* n. g. et sp. Mandible.
17. „ „ 1st gnathopod.
18. *Podocerus multispinis* n. sp. 2nd gnathopod.



del. K. H. B.

10. *Contributions to the Crustacean Fauna of South Africa.*—By K. H. BARNARD, M.A., D.Sc., F.L.S., Assistant Director.

NO. 9. FURTHER ADDITIONS TO THE LIST OF ISOPODA.

(With 6 Text-figs.)

SHORTLY after the publication of my last paper on S. African Isopods (Ann. S. Afr. Mus., xvii, 5, 1920) I was able to consult Vanhöffen's paper on the Isopods of the German South Polar Expedition. Unfortunately, in many cases this author seems to have been only partly conversant with the literature of the subject, and several of his descriptions are entirely superficial and inadequate (*e.g.* those of the interesting Anthurid genus *Eisothistos*).

The following notes on the S. African species mentioned by Vanhöffen are offered :—

Tanais gracilis Heller. Simonstown. My *spongicola* 1914 is considered by Vanhöffen to be Heller's species. This seems quite likely, and I would be disposed to put *gracilis* on the fauna list, making *spongicola* a synonym. That the female has only one marsupial pouch is, however, not correct.

Heterotanaïs (?) *capensis* Vanh. The suggestion in my 1920 paper that my *Paratanaïs euelpis* might be this species is not valid. The number of joints in the uropods show that these two species are distinct.

Leptanthura laevigata (Stmpsn.). Vanhöffen is, I think, correct in his identification of Stimpson's species. *L. faurei* 1914 is synonymous.

Eurydice latistylis Dana. The statement that Dana's species has never been found again is quite incorrect; see Stebbing in Fauna Flora Laccad. Maldive, 1904, p. 702, and records there quoted. The species is apparently a true *Cirolana* and not an *Eurydice*.

Eurydice natalensis Vanh. This is not an *Eurydice*, but belongs to my genus *Pontogeloides* 1914. The 1st antenna is of exactly the same character, as is likewise the uropod. With the exception of the number of joints in the antennae, the only specific difference between *natalensis* and *latipes* is the notch on the outer margin of inner uropodal ramus in the latter. Vanhöffen's description, however, lacks all mention of the frontal lamina, the mouth-parts, and the pereopods.

Astacilla setosa Vanh. This is one of the several varietal forms of *Arcturella corniger* (Stebb.); see my 1920 paper, p. 391.

Antias uncinatus Vanh. Found at Simonstown. An Antarctic genus, whose occurrence here is somewhat unexpected.

Austrofilius furcatus Hodgson. This species first described from M'Murdo Sound (Antarctic) was discovered by the "Gauss" at Kerguelen and Simons-town. According to Vanhöffen there are no essential differences between his material and the type, which he apparently examined.

Paramunna capensis Vanh. Easily distinguished from the other two Cape species, *laevifrons* Stebb. and *concaivrons* Brnrd., by its serrate pleon.

FAMILY TANAIDAE.

Leptochelia savignyi (Kröyer).

1842. *Tanais savignyi*. Kröyer, Naturhist. Tidsskr., vol. iv, p. 168, pl. ii, figs. 1-12 (♀).
 1842. „ *dubius*. *Id.*, *ibid.*, p. 178, pl. ii, figs. 20-22.
 1842. „ *edwardsi*. *Id.*, *ibid.*, p. 181, pl. ii, figs. 13-19 (♂).
 1886. *Leptochelia savignyi*. G. O. Sars, Archiv. Math. Naturwid., Christiania, vol. ii, p. 326, pl. ix, figs. 4-8 (♂ and ♀).
 1900. „ *lifuensis*. Stebbing, *loc. cit.*, p. 616, pl. liv, C (♀), D (♂), and pl. lv, B (♂).
 1900. „ sp. Borradaile, Proc. Zool. Soc. Lond., 1900, p. 797, pl. li, figs. 2-2c.
 1905. „ *savignyi*. Richardson, Bull. U.S. Nat. Mus., No. 54, p. 26, text-figs. 26-28. (References and synonymy.)
 1905. „ *dubia*. *Id.*, *ibid.*, p. 28, text-fig. 29.
 1905. „ *lifuensis*. Stebbing, *loc. cit.*, p. 7, pl. i, C (♂ ♀).
 1910. „ „ *Id.*, J. Linn. Soc., vol. xxxi, p. 216.
 1918. „ *dubius*. *Id.*, Ann. Durban Mus., vol. ii, pt. 2, p. 62, pl. ix, A.
 1920. „ *savignyi*. Barnard, Ann. S. Afr. Mus., xvii, 5, p. 332.

According to Miss Richardson *dubia* is distinguished from *savignyi* by a constant difference in the number of joints in the inner ramus of the uropod, the former having 5, while the latter has 6.

But in his report on Herdman's Ceylon collection Stebbing has given details of several specimens, which he assigns to *lifuensis* Stebb., showing that the presence of one joint more or less either in the outer or the inner ramus is a variable feature, and one, moreover, entirely independent of sex. Read in conjunction with the original description this fact becomes even clearer.

In my MSS. (1917) I had identified the Cape and Natal specimens

as *lifuensis*, but Mr. Stebbing's 1918 determination of the Durban specimens as *dubius* caused me to revise my identification. Thus I find myself unable to separate *lifuensis* from *savignyi* in view of the similarity in the 1st peraeopods (gnathopods) and the variability in the rami of the uropods. The flagellum of the 1st antenna in ♂ varies from 6–8-jointed.

It may be noted that in 1918 Stebbing has by a slip written "finger" instead of "thumb," and that the thumb is represented in the figure as only unidentate instead of bidentate on the inner margin, as stated in the text.

Geogr. Distribution.—*L. savignyi* has a wide distribution on both sides of the North Atlantic as far south as Senegal and Madeira, and the Azores, and including the Mediterranean (see Richardson); *dubia* is recorded from the W. Indies and Brazil (see Richardson); and *lifuensis* is widely distributed in the Indo-Pacific, being recorded by Stebbing from the Loyalty Islands and Isle of Pines, Ceylon, and the Red Sea.

FAMILY GNATHIIDAE.

Gnathia cryptopais Brnrd.

1925. *Gnathia cryptopais*. Barnard, Ann. Mag. Nat. Hist., (9) 15, p. 417.

Male.—Head smooth, dorsally concave in front, anterior margin with a large median semicircular crenulate lobe. Antero-lateral angles, shortly but acutely produced. Eyes not very prominent.

Peraeon segments 2 and 3 subequal in length, a short constriction between segments 3 and 4; segments 4–6 subequal in length, with only shallow grooves separating them, lateral margins and postero-lateral angles of segment 6 rounded, no median longitudinal depressions.

Pleon shorter than peraeon segments 4–6 together.

Telson with lateral margins slightly concave, apex acute.

Lateral margins of peraeon and pleon segments with moderately numerous outstanding setae.

First antenna, 3rd joint of peduncle longest, flagellum 4-jointed.

Second antenna subequal to 1st, ultimate peduncular joint longest, flagellum 5-jointed.

Mandible narrow, apex acute, outer margin with a very indistinct tooth, inner margin biconcave, the basal concavity matching the median lobe of head when the mandible is closed.

Maxilliped, 2nd joint strongly produced on inner distal margin, exceeding the 1st palpal joint, 4th palpal joint not incurved.

First peraeopod broadly subtrigonal, inner and outer margins both convex.

Second to sixth peraeopods very feebly tuberculate.

Pleopods with 2 hooked setae on peduncle, rami narrow and subequal.

Uropod, outer ramus narrower and shorter than inner, both with simple setae.

Length.—2 mm.

Colour.—In spirit, whitish, eyes reddish.

Locality.—Duminy Point (off Saldanha Bay), E. by N. $\frac{1}{2}$ N., distant 8 miles, 87 fathoms, 1♂, 1 juv. S.S. "Pieter Faure," 17/3/02. (S.A.M., No. A 6051.)

This species is very closely allied to *G. cerina* Stimps. judging by Miss Richardson's figures in the Monograph of N. American Isopods, 1905, p. 60. The present species, however, is perfectly smooth, not granulate as in fig. 43 copied from Harger, and there is no longitudinal groove on segment 5. The mandible also is distinctly biconcave, not as in Miss Richardson's figure concave only in the distal half of the inner margin. The Cape species, therefore, may claim for the present specific distinctness.

It is distinguished also from *G. richardi* Dollf., 1901, by its broader head and peraeon and by the presence of the acute antero-lateral angles of the head. The frontal lobe is more prominent and semi-circular. The mandibles, however, of the two species are very similar.

An interesting point about the larva is that it is completely enclosed, except the mouth-parts and front part of the head, in a covering of monaxonid sponge spicules, the pleon being doubled up under the peraeon in Brachyuran fashion. This coating seems to have been constructed by the animal, as it does not have the appearance of being a self-grown sponge. The specific name refers to this peculiarity.

Gnathia aureola Stebb.

1900. *Gnathia aureola*. Stebbing, in Willey's Zoo. Res., pt. 5, p. 627, pls. lxvi, A and lxxiv, E (juv.).

1906. " " Nobili, Mem. R. Ac. Sci. Torino, ser. 2, vol. lvii, p. 419, pl. ii, fig. 7, pl. iii, fig. 7 (juv.).

A specimen of a larval *Gnathia* which was found in the gills of an *Aetobatis narinari* Euphrasen from the coast of Natal, and which agrees with Stebbing's and Nobili's accounts, may be assigned to *aureola*, seeing that both these authors record it from the same species of fish.

Other specimens, not differing apparently from the first specimen, were found in the gills of *Dasybatus pastinaca*, also from the Natal coast.

As in Stebbing's specimens the body has become much darkened in the preservative without any indications of golden spots or rings.

Length.—6 mm.

Colour.—In spirit, the head, anterior part of peraeon, and the pleon light brown, swollen part of the peraeon dark blue-grey.

Locality.—Natal coast, from gills of *Aetobatis narinari* and *Dasybatus pastinaca*. (S.A.M., Nos. A 6287 and A 6288.)

Geogr. Distribution.—Loyalty Islands (Stebbing); Mangareva, Polynesia (Nobili). In gills of *Aetobatis narinari*.

The relation between this species and the earlier *Anceus rhinobatis* Kossmann, 1880, from the Red Sea, *A. torpedinis* Walter, 1885, from Ceylon, and *G. aldabrensis* Schoen, 1908, has yet to be studied. It is probable that all will eventually prove to be the same species, which will then be known as *G. rhinobatis* Kossm.

FAMILY ANTHURIDAE.

For revision of family see: 1925. Barnard, J. Linn. Soc. Lond. vol. xxxvi, p. 109.

Gen. HALIOPHASMA HASW.

1925. Barnard, J. Linn. Soc. Lond., vol. xxxvi, p. 131.

Haliophasma tricarinata Brnrd.

1925. Barnard, *loc. cit.*, p. 132, pl. iv, fig. 2.

Immature (? ♂).—Body narrow, smooth. Head very slightly longer than broad, with median point and rounded antero-lateral angles. Eyes well developed but not bulging.

Peraeon segments plano-convex dorsally, broadly rounded ventrally (except segment 1, which is strongly keeled), with a lateral groove on each but no keel, a section through middle of body being thus almost square with the angles slightly rounded off. A shallow oval pit in anterior half of segments 4–6. Segments 1–3 and 6 subequal, 4 and 5 a little longer, 7 considerably shorter.

Pleon segments 1–5 together subequal to 7th peraeon segment, the sutures indistinct, especially dorsally.

Telson elongate linguiform, apex rounded, sparsely setose, dorsal surface with 3 raised longitudinal ridges reaching apex but not the base, interstices between the ridges, and between the ridges and the lateral margins shallowly pitted, ventral surface with a median longitudinal rounded ridge from apex to near base.

First antenna, 1st joint largest, 2nd and 3rd smaller and subequal, flagellum of 1 distinct and 1 rudimentary terminal setiferous joint.

Second antenna, 2nd joint largest, grooved, 3rd-5th increasing slightly in length, flagellum shorter than 5th joint, consisting of 1 distinct and 3-4 rudimentary terminal setiferous joints.

Mandible, cutting plate with few and feeble denticulations, 1st and 3rd palpal joints subequal.

Maxilliped with small but distinct inner plate, 3rd joint with indistinct suture near base and distinct apical oblique suture, whole appendage therefore 5- or 4-jointed, according as the partial suture is considered to delimit a joint or not.

Peraeopod 1 stout, 3rd joint unusually long, apically lobed, 4th transverse, lobed on upper margin, 5th apically subacute, not projecting, 6th broadly oblong with rounded posterior margin, palm nearly transverse owing to its being expanded into a convex place, finely and regularly serrulate, finger stout, matching palm, inner margin smooth.

Peraeopods 2 and 3 arising from under a short lateral keel, 5th joint underriding the elongate-oblong 6th.

Peraeopods 4-7, 5th joint not underriding 6th. Peraeopod 7 slightly more slender than preceding ones.

Pleopod 1, outer ramus opercular but not indurated, outer surface shallowly and sparsely pitted, inner ramus half width of outer.

Pleopod 2, without trace of stylet on inner ramus.

Uropod, inner ramus not reaching telsonic apex, 1st joint deeply grooved for reception of outer ramus, 2nd joint as wide as 1st, longer than wide, apex rounded, outer and apical margins denticulate and fringed with simple setae, outer ramus ovate with strongly excavate outer distal margin, apex acute, outer margin denticulate and fringed with plumose setae.

Length.—15 mm.; *breadth*, 1 mm.

Colour.—In spirit, dull pinkish, eyes dark red-brown.

Locality.—Cape St. Blaize, N., distant 12 miles, 42 fathoms, 1 specimen, posterior portion only; Cape St. Blaize, N.E. by N. $\frac{1}{4}$ N., distant 11 miles, 40 fathoms, 1 immature (σ). S.S. "Pieter Faure," 22/10/00 and 24/10/00. (S.A.M., Nos. A 5967-8.)

Haliophasma coronicauda Brnrd.

1925. Barnard, *loc. cit.*, p. 132.

Immature σ .—Body narrow, smooth. Head a little longer than broad, with median point and rounded antero-lateral angles. Eyes

well developed but not bulging. Peraeon segments plano-convex dorsally, keeled laterally and ventrally, decreasing slightly in length posteriorly to the 6th; 7th considerably shorter than 6th.

Pleon segments 1-5 together equal to or very slightly longer than 7th peraeon segment, sutures distinguishable but not deep.

Telson ovate with rounded apex bearing a few setae, dorsal surface with an oval raised central portion like the crown of a hat surrounded by a flat rim.

First antenna, 1st joint largest, 2nd and 3rd smaller and subequal, flagellum a little shorter than peduncle, 5-jointed.

Second antenna, 2nd joint largest, grooved, 3rd and 4th subequal, 5th rather longer, flagellum longer than 5th but shorter than 4th plus 5th, 5-jointed.

Mandible, 1st and 3rd palpal joints subequal.

Maxilliped resembling that of a ♀ specimen of *A. gracilis*, as figured by Sexton (1914, J. Mar. Biol. Assoc., vol. x, No. 2, p. 241, fig. 8), but with a distinct transverse suture across the widest portion of the 2nd (in the figure) joint, and another oblique suture from the apical group of setae to the outer margin. Counting the fused basal joint the appendage is therefore 5-jointed. Epipod oval.

Peraeopod 1 stout, 5th joint with blunt apex, 6th elongate-ovate, projecting backwards to posterior margin of 4th, palm gently convex, setose, finger plus unguis matching palm but a little longer, inner margin smooth.

Peraeopods 2 and 3 not stout, 5th joint underriding the elongate-oblong 6th.

Peraeopods 4-7, 5th joint not underriding 6th. Peraeopod 7 rather more slender than preceding ones.

Pleopod 1, outer ramus opercular but not indurated, outer (ventral) surface with a longitudinal groove from base to near apex, nearer inner than outer margin, rest of surface smooth, inner ramus half width of outer.

Pleopod 2 without any trace of a stylet on inner ramus.

Uropod, inner ramus reaching telsonic apex, 1st joint obliquely grooved for reception of inner margin of outer ramus, 2nd joint as wide as 1st and a little longer than wide, subtrigonal with rounded apex, outer ramus not meeting its fellow in middle line, narrow-ovate with concave outer distal margin and subacute apex, margins of both rami fringed with setae.

Length.—16 mm.; *breadth*, 1.5 mm.

Colour.—In spirit, dull pinkish, eyes dark brown.

Locality.—Duminy Point (off Saldanha Bay), E. by N. $\frac{1}{2}$ N., distant 8 miles, 87 fathoms, 2 immature (♂♂). S.S. "Pieter Faure," 17/3/02. (S.A.M., No. A 5962.)

MALACANTHURA Brnrd.

1925. Barnard, J. Linn., Soc. Lond., vol. xxxvi, p. 133.

Malacanthura linguicauda (Brnrd.).

1920. Barnard, Ann. S. Afr. Mus., vol. xvii, 5, p. 338.

An additional specimen has come to hand in which the 1st antenna is not elongate, 1st joint largest, 3rd longer than 2nd, flagellum equal to 3rd joint, consisting of one joint with a minute apical joint bearing a tuft of long setae.

The finger (7th joint) of 1st peraeopod bears 4 rounded denticles, of which the distal one is largest. Pleopod 2 without stylet.

Length.—10.5 mm.

Locality.—Lion's Head (Cape Peninsula), S.E., distant 22 miles, 95 fathoms, 1 immature (? ♂). S.S. "Pieter Faure," 6/3/00. (S.A.M., No. A 5966.)

Gen. EXANTHURA Brnrd.

Exanthura filiformis (Lucas).

1920. Barnard, Ann. S. Afr. Mus., xvii, 5, p. 340.

1925. *Id.*, J. Linn. Soc. Lond., vol. xxxvi, p. 131, pl. iv, fig. 22.

Further specimens from the following localities have come to hand since the above-quoted description was published.

Lion's Head (Cape Peninsula), S.E., distant 22 miles, 95 fathoms, 1 ♂; Cape Infanta, N.E. by N. $\frac{1}{2}$ N., distant 13 miles, 43 fathoms, 1 ♂. S.S. "Pieter Faure," 6/3/00 and 1/7/00. (S.A.M., No. A 5964-5.)

The second specimen resembles the ♂ described in 1920 in every respect, including length (23 mm.). But the first specimen is interesting as being only 16 mm. long, and yet showing the greatly elongate and swollen 1st antennae characteristic of breeding males.

The 1st antenna reaches back to the middle of 2nd segment; it is cylindrical and of equal width throughout until near the apex, where it tapers gently; its width equal to half that of the head. Three basal joints can be distinguished, nearly as long as wide, followed by about 23 joints twice as wide as long; the last 2 joints are small and conical, the apical one bearing a small tuft of setae. With the exception of this apical tuft the whole antenna is devoid of setae.

The 2nd antenna shows the following differences from that of the specimen already described. The 2nd joint is more flattened dorso-ventrally so as to form a bed for the base of the swollen 1st antenna ; in other words, the upper ridge, which is well developed in the non-breeding male, is here obsolete. Further, there is a subacute tooth pointing forwards developed on the outer margin of the 1st or 2nd joint ; as the suture is indistinct a little uncertainty exists as to which joint really bears the tooth. The flagellum is scarcely more than half the length of 5th peduncular joint, instead of being only a little shorter, and consists of 2 joints, the terminal one small and conical with a small tuft of setules.

No trace of a stylet on inner ramus of 2nd pleopod.

In spite of the considerable changes, in particular the disappearance of the recurved process on 1st joint of 1st antenna, which thus seem to take place in the breeding male, it is quite clear that we are dealing with the same species ; for in every other morphological feature there is complete agreement. The absence of whorls of long setae is paralleled in Norman and Stebbing's figure of *Anthura gracilis* (1886, Tr. Zool. Soc., vol. xii. p. 123, pl. xxv, III, D♂). On the following page (124) these authors remark that the specimen described and figured was probably immature, and that "after the exuviation which should bring it to its perfect state, the upper antennae would have a plumose flagellum." The adult male with plumose antennae was described and figured by Sexton (1914, J. Mar. Biol. Assoc., vol. x, 2, p. 237).

FAMILY AEGIDAE.

Gen. AEGA Leach.

Aega antillensis Sch. and M.

1879. *Aega antillensis*. Schiödte and Meinert, Naturh Tidsskr., ser. 3, vol. xii, p. 361, pl. viii, figs. 10-13.
 1905. „ „ Richardson, Bull. U.S. Nat. Mus., No. 54, p. 170, figs. 149, 150.
 1910. „ „ Thienemann, Abh. Ak. Wiss., II, Suppl. Bd. 3 Abh., p. 26, pl. i, figs 1, 2.

This specimen appears to agree exactly with Thienemann's specimens from Japan, which he identified as *antillensis*. I am inclined to think that a comparison with Schiödte and Meinert's type would show that a new name should be applied to the Japanese and S. African specimens.

The shape of the frontal lamina especially seems distinctive. In Schiödte and Meinert's figure it is rounded posteriorly, with a straight or slightly concave anterior margin. In the present specimen, as also in the Japanese ones, so far as can be judged from Thienemann's photographs, these features are exactly reversed.

In other respects there seem no differences worth recording.

Length.—40 mm.

Colour.—Dirty greenish-white.

Locality.—Off Umvoti River, Natal, 130 fathoms. S.S. "Meikle," per H. W. Bell-Marley, 1923. (S.A.M., No. A 6597.)

Distribution.—West Indies, 163–231 fathoms (Schiödte and Meinert, Richardson); Japan, 50 fathoms (Thienemann).

FAMILY CYMOTHOIDAE.

Gen. NEROCILA Leach.

References after 1914 are as follows:—

1915. Nierstrasz, Zool. Medel., i, pt. 1, p. 72.

1918. *Id.*, *ibid.*, iv, pt. 2, p. 108.

Nerocila armata Dana.

1853. *Nerocila armata*. Dana, U.S. Expl. Exp., vol. xiii, p. 761, pl. i, figs. 10, *a-d*.

1879. „ *rhabdota*. Koelbel, S.B. Ak. Wiss. Wien., Bd. 78, Abt. 1.

1881. „ „ Schiödte and Meinert, Naturh. Tidsskr., ser. 3, vol. xiii, p. 39, pl. ii, figs. 5, 6.

1881. „ *cephalotes*. *Id.*, *ibid.*, p. 60, pl. iv, figs. 16, 17.

1902. „ „ Stebbing, S.A. Crustacea, pt. 2, p. 55.

1914. „ *rhabdota*. Barnard, Ann. S. Afr. Mus., vol. x, pt. 11, p. 371.

1921. „ *armatus*. Stebbing, Ann. Durb. Mus., vol. iii, pt. 1, p. 23.

1924. „ *cephalotes* and *rhabdota*. Monod, Parasit. Mauritan. Isop., pp. 75, 79, figs.

In the 1914 paper I have recorded two examples of *rhabdota* from S. Africa, one of which had the inner ramus of the uropods shaped as in *cephalotes*.

I have now come to the conclusion, based on abundant material

collected by myself in 1922 during a trawling expedition on the Agulhas Bank, that these two species cannot really be separated specifically.

A comparison of the descriptions of the two forms given by Schiödte and Meinert shows that, with the exception of the lateral angles of the peraeon segments and the epimera, there is scarcely any difference between them; they are, in fact, almost word for word the same.

The *rhabdota* form has the postero-lateral angles of the posterior peraeon segments considerably produced, that of the 7th segment extending to the lateral angles of the 4th or 5th pleon segment, to which level the inferior angles of pleon segments 1 and 2 also extend. The 3 anterior epimera are posteriorly acute.

The *cephalotes* form has the postero-lateral angles of the posterior peraeon segments much shorter, that of the 7th segment not reaching as far as inferior angles of pleon segments 1 and 2, which scarcely reach the angles of the 4th pleon segment. The 3 anterior epimera are posteriorly obtuse.

Between these two extreme forms I have a series exhibiting a complete gradation, in view of which it seems impossible to maintain both specific names. Monod, however, is of opinion that they can and should be maintained as distinct species.

The typical *cephalotes* form is more abundant at the Cape than the *rhabdota* form, as Monod also found in N. Africa.

The shape of the inner ramus of the uropod varies considerably. The typical shape is described by Schiödte and Meinert. The most aberrant form I have seen is falcate, tapering from the rather swollen base to an acute apex, similar to that figured by the joint authors for *japonica* (*loc. cit.*, pl. ii, fig. 1). The tooth on the inner margin is usually present, but, as in the last-mentioned variation, may be entirely absent.

Stebbing has recently identified *cephalotes* with Dana's *armata*.

In life the colour is uniform cream, the eyes dark but very indistinct. I have seen no specimens exceeding Schiödte and Meinert's measurement of 36.5 mm.

The animals are found clinging to the skin and especially the fins of various kinds of fishes: Silver-fish (*Dentex*), Panga (*Pagrus*), White Stumpnose (*Chrysophrys*), and Sole (*Synaptura*). There is one specimen in the collection from Algoa Bay, received from a correspondent who stated on the accompanying label that it was "from mouth of *Trachynotus*." So far as my own experience goes it is exclusively an ectoparasitic form.

Nerocila serra Sch. and M.

1881. *Nerocila serra*. Schiödte and Meinert, Naturh. Tidsskr., ser. 3, vol. xiii, p. 17, pl. i, figs. 12-14.

1915. „ „ Nierstrasz, Zool. Medel., i, 1, p. 74.

One typical specimen agreeing with the original description.

Length.—20 mm.

Colour.—Pale horn-colour, with a median and one lateral orange longitudinal stripe, the lateral stripe continued on to the outer ramus of uropod, eyes inconspicuous.

Locality.—Delagoa Bay (H. W. Bell-Marley, 1923), 1 ovig. ♀ on tail of a *Sargus* sp. (S.A.M., No. A 6600.)

Geogr. Distribution.—Bankes Straits; Java Sea.

Nerocila phaeopleura Blkr.

1857. *Nerocila phaeopleura*. Bleeker, Crust. Ind. Archip., p. 25, pl. i, fig. 3.

1881. „ „ Schiödte and Meinert, *loc. cit.*, p. 13, pl. i, figs. 6, 7.

1915. „ „ Nierstrasz, *loc. cit.*, p. 75, pl. iii, figs. 1, 2.

1918. „ „ *Id.*, *loc. cit.*, p. 113, pl. ix, figs. 6, 7.

A typical example, a young (?), 21 mm. long, from the tail of *Chirocentrus dorab*, Natal coast. (H. W. Bell-Marley. S.A.M., No. A 6310.)

Geogr. Distribution.—East Indies.

Gen. ANILO CRA Leach.

Anilocra leptosoma Blkr.

1875. *Anilocra leptosoma*. Bleeker, Verh. Nat. Ver. Nederl. Ind., v, 2, No. 5, p. 30, pl. i, figs. 6, *a*, *b*.

1879. „ *alloceraea*. Koelbel, Neu. Cym., p. 7, pl. ii, figs. 1, *a-e*.

1881. „ *leptosoma*. Schiödte and Meinert, Naturh. Tidsskr., ser. 3, vol. xiii, p. 108, pl. viii, figs. 2, 3.

1915. „ „ Nierstrasz, Zool. Medel., i, 1, p. 87.

Typical specimens agreeing with the descriptions.

Length.—♀ 34 mm.

Colour.—Grey, speckled at the sides and on telson, eyes black.

Locality.—Delagoa Bay (H. W. Bell-Marley, 1923), 2 ♂♂, 2 ♀♀ (1 ovig.). (S.A.M., No. A 6599.)

Geogr. Distribution.—Sumatra, Java, Philippine Islands.

Gen. CTEATESSA Sch. and M.

1883. *Cteatessa*. Schiödte and Meinert, Naturh. Tidsskr., ser. 3, vol. xiii, p. 296.

Cteatessa retusa Sch. and M.

1883. *Cteatessa retusa*. Schiödte and Meinert, *loc. cit.*, p. 297, pl. ii, figs. 11–13.

1910. „ „ Stebbing, Gen. Cat. S.A. Crust., p. 424.

A fine ovigerous ♀, together with a ♂, sent by Mr. H. W. Bell-Marley, who found it in the mouth of a *Hemirhamphus far* in Durban Bay. As this species does not seem to have been met with since Schiödte and Meinert described it, and as the ♂ and young still remain unknown, a few notes may be useful.

The original description applies well to the present ♀. The head is a little more sharply pointed in front than in Schiödte and Meinert's figure.

Male.—Head similar to that of the ♀. Eyes distinct and moderately large. 1st peraeon segment without the lateral keel of the ♀. Posterior side-plates not so deep as in ♀. Telson with only a slight distal emargination. Two stout penial processes on 7th peraeon segment. Second pleopod apparently without stylet. Pitting on dorsal surface not visible.

Young.—Specimens 4 mm. in length have the ungues of the anterior 3 pairs of peraeopods denticulate.

Length.—♂ 12 mm., ♀ 33 mm.; *breadth*, ♂ 3·5 mm., ♀ 12 mm.

FAMILY IDOTEIDAE.

Gen. CLEANTIS Dana.

1826. *Zenobia*. Risso, Hist. Nat. Eur. Merid., vol. v, p. 110.

1849. *Cleantis*. Dana, Amer. J. Sci., ser. 2, vol. viii, p. 427.

1853 „ *Id.*, U.S. Explor. Exp., pp. 697, 707.

1881. „ Miers, J. Linn. Soc. Lond., vol. xvi, p. 76 (part).

1893. „ Stebbing, Hist. Crust., p. 375.

1895. *Zenobiana*. *Id.*, Ann. Mag. Nat. Hist., ser. 6, vol. xv, p. 24.

1904. „ Norman, *ibid.*, ser. 7, vol. xiv, p. 443.

1905. *Cleantis*. Richardson, Bull. U.S. Nat. Mus., No. 54, p. 404.
 1911. „ Tattersall, Nord. Plankton. Isopod., p. 231.
 1912. „ Richardson, Proc. U.S. Nat. Mus., vol. xiii,
 p. 27.
 1913. „ Issel, Ann. Mus. Zool. Napoli, p. 1.
 1917. *Zenobiana*. Collinge., Tr. Roy. Soc. Edin., vol. li, pt. 3,
 p. 749.
 1921. *Cleantis*. Tattersall, Mem. Asiat. Soc. Beng., vol. vi, p. 425
 (discussion of synonymy of genus).

Cleantis natalensis n. sp.

Very close to the West Indian *C. planicauda* Bened.

The peduncle of 2nd antenna is closely similar to Miss Richardson's description of that of *C. japonica* 1912, but Benedict does not fully describe this appendage, and consequently a comparison is not feasible.

Second and third joints of peduncle of 2nd antenna produced on inner ventral side, the projection of the 2nd joint, *when viewed from below, apically bifid*, that on 3rd joint apically subacute; both joints as well as the 4th joint with the inner ventral margin keeled. Flagellum of a single joint.

The 3 joints of the peduncle of the 1st antenna triquetral in section. Maxilliped with 5-jointed palp.

Fourth pereopod without anguis.

Uropod with plumose seta at outer apical angle of peduncle representing outer ramus.

Colour.—"Dark brown" in life; the spirit specimens show 6 dorsal longitudinal dark lines as in *planicauda* and *japonica* (the latter is said to have 5 lines, the mid-dorsal one being apparently counted as one instead of two); the epimera also are darker than the rest of the body.

Length.—11.5 mm.

Locality.—Durban Bay, "in sea-weed" (H. W. Bell-Marley coll., Oct. 1918), 2 immature apparently ♀♀. (S.A.M., No. A 6308.)

FAMILY ASTACILLIDAE.

Gen. ANTARCTURUS zur Strassen.

See Stebbing, S.A. Crust., pt. 4, p. 52, 1908.

Including the species described below, two species of this genus

have now been recorded from South Africa. The first species was *A. kladophoros*, Stebb., *loc. cit.*, p. 53, pl. xxxii.

This species was founded on a female only. In 1914 I described what I considered to be the male (Ann. S.A. Mus., vol. x, pt. 7, p. 212, pl. xviii, B), the reasons for this correlation being the general conformity in size, the number of the cephalic spines, the presence of the 2 hooked spines on the posterior margin of 4th segment, and the similarity in the armature of the peduncles of 1st pleopods.

The most striking difference in the sculpture, *i.e.* the greater number and complexity of the spines on the body, 2nd antennae and legs, may well be merely sexual and not specific. The following species exhibits in some ♀ specimens much more *pointed* tubercles than the males.

There remains the fact that in the supposed male of *kladophoros* the 4th segment is elongated, though not exceedingly. This feature is decidedly unusual, both in this genus and in *Arcturus*, although as a large number of the species are known only from females it cannot yet be decided whether it might be utilised as a generic character. It is thought advisable, however, to remark on this feature here, seeing that the two South African species differ so conspicuously in this respect.

Another feature which badly needs investigating in the species already described is the shape of the 1st pleopod in ♂, which will probably be found to be of value in specific differentiation. The male penial process should also be examined.*

Antarcturus similis n. sp.

Body granular, the granules often pointed but not subspiniform.

Head in ♂ with 2 large submedian blunt tubercles behind the level of the hind margin of eyes, in ♀ with 2 smaller tubercles in the same position followed by 2 more of nearly equal size. Occasionally 2 smaller tubercles on front margin. Eyes large, suboval.

Peraeon segments, each with a pair of submedian granules larger than the rest, and thus forming 2 longitudinal ridges down the body, more prominent in ♀ than ♂, those on 4th segment being the most prominent in the ♂; in ♀ also a lateral ridge is similarly indicated but not distinctly, except on segments 4 (5) to 7.

* Since this was written, Tattersall has drawn attention to the specialisation of the 1st pleopods as accessory copulatory organs (1921, Terra Nova Reports Zool., III, 8, p. 193).

Segment 1 not downwardly produced so as to hide mouth-parts. In ♂ the segments decrease in breadth slightly towards the posterior end; in ♀ segments 2 and 3 are angularly produced at the sides, being considerably wider than 1st, the succeeding segments decreasing in width. Fourth segment not longer than 3rd in either sex. Epimera very small and shallow.

Pleon of 3 segments in advance of the telson, each with the 2 submedian larger granules forming ridges in continuation of those on the peraeon, more distinct in ♀, in which also the lateral ridges occur.

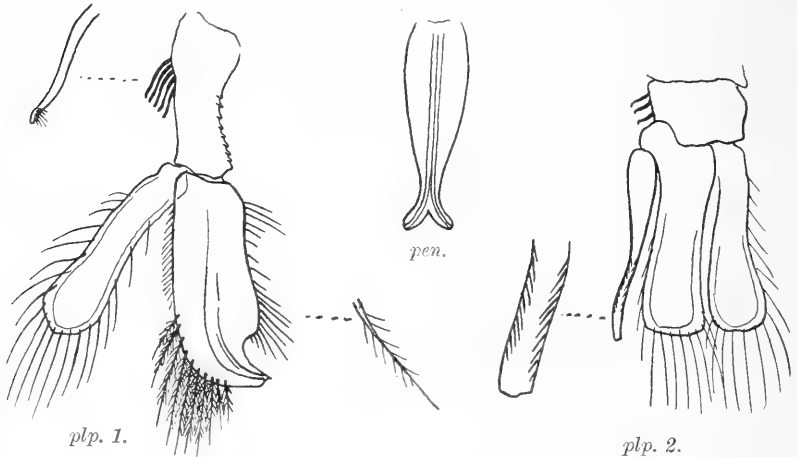


FIG. 1.—*Antartecturus similis* n. sp. Penis, first and second pleopods of male: the setae on the inner ramus of the first pleopod are all plumose, though shown as simple in the above figure.

Telson not greatly longer than broad, with a tooth on lateral margin near base and another less well marked (especially in ♀) distally, apex subacute, not strongly produced, in ♂ a large median blunt or sometimes pointed tubercle at base, and 3 pairs of granules larger than the others, forming 2 ridges distally; both these features usually absent in ♀, in which surface is merely finely granular, but the median tubercle is sometimes well marked in young ♀♀; it may even be absent in the ♂ (see specimen No. A 5953).

Thus the development of the granules varies, as may also their shape; in some young ♀♀ all the granules are sharply pointed, in other specimens they are all blunt, so that at first sight one would suspect there to be two species.

No ventral knobs or processes on peraeon segments.

First antenna reaching to middle of 3rd joint of 2nd antenna, 1st

joint stout, 2nd and 3rd much more slender, 3rd shorter than 2nd, flagellum equal to 2nd plus 3rd, apex blunt, lower margin sparsely setose.

Second antenna reaching back to 5th segment, 2nd and 3rd joints obscurely (especially in ♀) granular, 5th slightly shorter than 4th, flagellum shorter than 5th, composed of 2 joints plus a terminal unguis. Both peduncle and flagellum sparsely setose, the setae short.

First peraeopod stout, 3rd joint shorter than 2nd, 4th and 5th broader than long, inner apex of 5th ending in a short acute point, 6th ovate, scarcely twice as long as broad, inner margins of 5th and 6th with dense (especially in ♂) fringe of doubly pectinate setae, 7th plus unguis nearly equal to 6th.

Second to fourth peraeopods slender, increasing in length, fringed with long setae.

Fifth to seventh peraeopods stout, with strong 7th joints and unguis.

Second joint in all the peraeopods obscurely granulate.

Four pairs of marsupial plates.

A single male appendage on 1st pleon segment, tapering distally and then dividing into two diverging arms, which are apically blunt. The vasa deferentia run contiguous along the whole length and then separate to open at the ends of the arms.

First pleopod in ♂ modified, peduncle elongate, strong and indurated, outer margin with ca. 9 denticles, inner margin with 5 hooked setae, outer ramus indurated, with a groove on its surface running to the apex; inner margin finely setulose, distal portion with long plumose setae, the apex acute and curved outwards, outer margin bisinuate, the distal excavation the deeper, margin with stout spines, inner ramus smaller, thin, margins with plumose setae; in ♀ not modified or indurated, peduncle with numerous denticles on outer and 4 hooked setae on inner margin, rami subequal, thin, margins with plumose setae.

Second pleopod in ♂, peduncle short, rami subequal, stylet, arising from base of inner ramus and equalling it in length, tapering, distal portion like one-half of a tube divided longitudinally, with a series of fine serrations along each margin.

Uropod apically pointed, setose, no internal ramus visible, outer surface granular with, in ♂, a median longitudinal keel and the inner and outer margins thickened, in ♀ smooth or only very slightly granular.

Length.—♂ 9 mm., ♀ 6 mm.; *breadth*, ♂ 1.75 mm., ♀ (across 2nd peraeon segment) 2 mm.

Colour.—In spirit, yellowish, eyes brown.

Locality.—Cape St. Blaize, N., distant 12 miles, 42 fathoms, 2 ♂♂, 2 ♀♀, 4 juv.; Vasco da Gama (Cape Peninsula), N. 40° E., distant 13 miles, 120 fathoms, 1 ♂; Cape Infanta, N.E. by N. $\frac{1}{2}$ N., distant 13 miles, 43 fathoms, 1 ♂; Cape St. Blaize, N.E. by N. $\frac{1}{4}$ N., distant 11 miles, 40 fathoms, 2 juv. ♀♀; Duminy Point (off Saldanha Bay), E. by N. $\frac{1}{2}$ N., distant 8 miles, 87 fathoms, 1 ♂. S.S. "Pieter Faure," 22/10/00, 4/5/00, 1/7/00, 24/10/00, and 17/3/02. (S.A.M., Nos. A 5951-5.)

This species is exceedingly close to *A. simplicissimus* Whitelegge, 1904. The only appreciable difference in the body sculpturing is the absence in Whitelegge's species of the median tubercle at the base of telson. But this may be absent also in the present species. The other slight differences might well be ascribed to variation, individual or local.

But added to the above difference is the very distinct difference in the 2nd antennae, and the different proportion of length to breadth in the 6th joint of 1st peraeopod. In *simplicissimus* the antennae are remarkably short for a member of this genus, or, indeed, family, and had Whitelegge not had 3 specimens one would have suspected a case of regeneration after an injury. The 6th joint of 1st peraeopod in the Australian species is 3 times as long as broad, whereas in the Cape species it is scarcely twice as long as broad.

There is a general superficial resemblance in the body sculpturing to *A. stebbingi* (Beddard), 1886.

Gen. ARCTURINA Koehler.

1911. *Arcturina*. Koehler, Bull. Inst. oc. Monaco, No. 214, p. 53.

This genus has hitherto contained only the type species, *A. rhomboidalis* Koehler, 1911, from the neighbourhood of Cape Verde. The discovery of a second species necessitates some remarks on the diagnostic characters of the genus.

The first point to be noticed concerns the anterior peraeopods. Koehler states that there is a "difference of structure" between the 2nd and 3rd peraeopods on the one hand, and the 4th peraeopod on the other. But his figures and description show that although there is a marked difference in *size* between the said peraeopods, the real difference of *structure* occurs between the *first* and the succeeding peraeopods. This is confirmed in the present species.

The 1st peraeopod is a normal 7-jointed (counting the 1st free joint as the 2nd) peraeopod with terminal unguis. In the 2nd-4th peraeo-

pods, however, the 7th joint is degenerate and the unguis has entirely disappeared. It is to be noted that Koehler has described the 2nd joint or basipodite in the 2nd-4th peraeopods as the ischiopodite, having apparently overlooked the real ischiopodite or 3rd joint. This is not surprising if in *rhomboidalis*, as in the present species, the 3rd and 4th joints are obscurely separated, although from its length the first free joint is obviously the 2nd joint.

The degeneration of the unguis, and also of the 1st peraeopod, may be observed in *Arcturus*, as pointed out by zur Strassen (Zool. Anz., vol. xxv, 1902, pp. 684, 685, fig. 1). This author remarks that the degenerate 1st peraeopod forms structurally, and probably also functionally, a transition to the maxilliped. In the present species, although this appendage is structurally a typical "leg," yet there is no doubt that functionally it serves as a maxilliped, because it is enclosed within what may be called a buccal chamber.

This buccal chamber seems to be quite unique in the family. It is not referred to by Koehler, unless he had it in mind when he wrote that the 4 anterior pairs of peraeopods form a compact mass "qui se termine en avant par un bord vertical au niveau de l'extrémité postérieure de l'œil" (*loc. cit.*, p. 60). From this statement I strongly suspect that *rhomboidalis* agrees with *hexagonalis* in possessing this same feature. But this feature deserves a more explicit description.

The buccal chamber is an extreme development of the downward projections of the 1st peraeon segment and the "cheeks" of the head which are seen in *Arcturus*, and is formed as follows:—The ventral margins of the head and 1st peraeon segment project ventrally as a raised rim, which is interrupted anteriorly in the middle line. This gap is filled, however, and the rim thus rendered continuous, by the epistomal portion of the head; it appears to be somewhat mobile, and rises to the same height as the rest of the rim. To it is movably articulated the upper lip, which projects horizontally into the chamber, *i.e.* at right angles to the epistome.

The chamber is closed ventrally by the closely imbricated 2nd-4th pairs of peraeopods with their fringes of long setae. Laterally the upper margins of the 2nd peraeopods are accurately apposed to the margins of the rim.

Within the chamber lie wholly concealed the 1st pair of peraeopods and the mouth-parts. The function of the 1st peraeopods as maxillipeds is therefore fairly certain, though the full biological significance of the whole structure may not become apparent until the opportunity occurs of watching living specimens in an aquarium.

It is to be regretted that no males of the South African species were collected, though, of course, the structure may be expected to be the same in both sexes.

The genus may be diagnosed as follows:—Body cylindrical, strongly bent between 4th and 5th segments, mouth-parts and 1st peraeopods concealed in a buccal chamber, formed laterally and anteriorly by the rim-like ventral margins of the head and 1st peraeon segment, and closed ventrally by the closely imbricated 2nd–4th peraeopods; 1st peraeopod with well-developed 7th joint and unguis, 2nd–4th peraeopods with rudimentary 7th joint bent inwards against 6th joint and no unguis, 4th segment elongate, more so in ♂ than in ♀, antero-laterally expanded in ♀, side-plates small or obscurely separated, 3 pairs of marsupial plates, that on 4th segment with inset-piece posteriorly, pleon with 3 segments in advance of telson, 3rd segment and telson somewhat indistinctly separated, pleopod 1 in ♂ with modified outer ramus.

Arcturina hexagonalis n. sp.

♀.—Body with thickly furry ridges but no granules, tubercles, or spines, strongly bent between 4th and 5th segments.

Head with short straight front margin with minute median point, antero-lateral angles reaching to base of 2nd joints of 2nd antennae, apically blunt, 2 submedian ridges from the level of eyes to posterior margin. Eyes prominent, subrotund.

First peraeon segment fused with head dorsally and dorso-laterally, with only a groove to mark the limits of the two. Ventrally the two are separated by an incision, though the margins are contiguous.

The ventral margins of the head and 1st peraeon segment form a raised rim surrounding the mouth-parts and concealing them when viewed from the side. This rim is discontinuous in front, but the gap is filled by the epistomal portion which bears the upper lip.

Second and third peraeon segments very short, increasing in width, like the 1st segment without dorsal ridges, the lateral portions nodular but without distinct epimeral sutures.

Fourth segment nearly half as long again as head plus segments 1–3, wider in front than 3rd segment, but width not equalling length, margins straight, converging to posterior end, which is only half the anterior width, antero-lateral angles nodular with shallow epimeral grooves. The thickened ridge-like margins and 2 submedian longitudinal parallel ridges densely furry.

Posterior margin of 4th segment indented, but the postero-lateral

angles not so prominently overlapping the 5th segment as represented in *A. rhomboidalis*. Segments 5-7 short and diminishing slightly in width posteriorly, each with a medio-dorsal furry ridge.

Pleon of 3 segments in front of telson, the 3rd indistinctly separated, each with 2 submedian furry ridges. Telson with basal tooth on lateral margin, and another slight one before the distal narrowing, apex rather more strongly and acutely produced than in *rhomboidalis*, with the margins slightly concave.

First antenna reaching to middle of 3rd joint of 2nd antenna, 1st

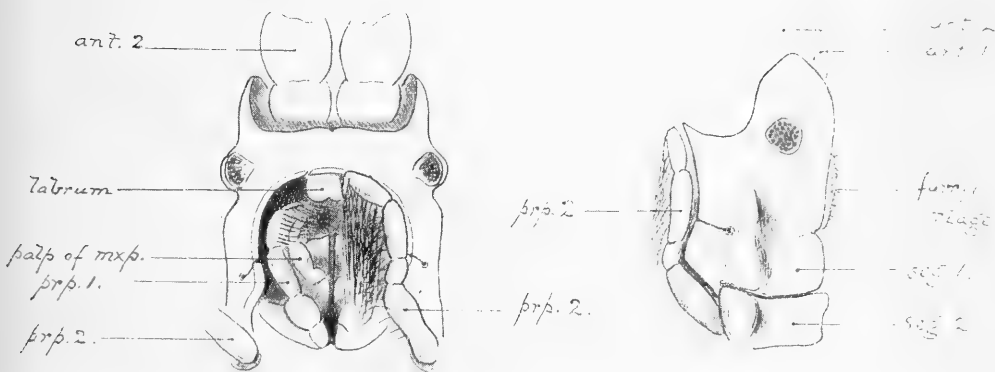


FIG. 2.—*Arcturina hexagonalis* n. sp. Ventral and lateral views of head and anterior peraeon segments. Enlarged.

joint not very stout, 2nd and 3rd more slender, 3rd shorter than 2nd, flagellum slender, as long as 2nd joint, with 2 long filiform and 3 sensory filamentous setae on apex.

Second antenna nearly as long as head plus segments 1-4, peduncle stout especially when viewed laterally, 4th joint longest, 5th longer than 3rd but more slender, upper and lower margins densely furry with a few longer setae, flagellum considerably more slender than 5th, also shorter, composed of 3 joints, the last with slender unguiform apex, the lower margins with regularly arranged minute bunches of setules.

Upper lip slightly asymmetrically bilobed.

Mandible with tridentate cutting edge, accessory cutting plate, spine-row, and strongly developed molar.

First maxilla with 3 plumose setae on inner plate; second maxilla with middle and outer plates together only half width of inner plate.

Maxilliped, inner plate almost as long as and quite as broad as 2nd joint, with 1 strong coupling-hook, distal margin truncate and slightly concave, palp with its 3rd joint longest, terminal joint well developed, setose, epipod large, subtrigonal, the basal granular portion not much larger than 2nd joint, but the rest formed of a perfectly transparent wide margin bearing a few setules on its edge, vibratory plate not greatly larger than 2nd joint, transversely oval, with a few setae on its transparent margin.

First peraeopod, 2nd joint longest, 4th a little longer than 3rd, its outer margin slightly expanded, 5th ovate longer than 6th, 7th half length of 6th, with slender unguis longer than itself, inner margins of 5th and 6th and outer distal margin of 6th with long spine-setae.

Second to fourth peraeopods increasing slightly in length, 2nd joint subequal to 5th, 3rd and 4th very short and indistinctly separated, 6th shorter than 5th, 7th bent inwards against and shorter than 6th, without unguis, inner margins of 5th, 6th, and especially 7th with very long setae.

The anterior four pairs of peraeopods form an imbricated series, lying closely packed one over the other. The first pair lie *within* the raised rim which forms a kind of buccal chamber; the 2nd pair lies with the upper (outer) margin contiguous with the margin of the rim, the sinuous curve of which corresponds with the curve of the jointed peraeopod. The 3rd and 4th pairs complete the closing in of the chamber so that the mouth-parts and 1st peraeopods are completely hidden from view.

Three pairs of marsupial plates. Careful search failed to reveal a pair on the 1st peraeopods. The plate on the 4th peraeopod is large, subrectangular, with small oval inset-piece, which does not, however, form the posterior apex of the plate as in *rhomboidalis*, lower margin densely setulose, a longitudinal furry ridge running along the middle of the plate.

A transverse section through the 4th segment with the marsupial plates is thus hexagonal in outline, whence the specific name, the 2 dorsal ridges, the lateral ones, and the two on the marsupial plates forming the angles.

Peraeopods 5-7 strong, a small accessory tooth at base of unguis, lower margins of all the joints densely furry.

Pleopod 1 very slender, peduncle with 3 hooked setae.

Uropod narrow, tapering to a fine point, concealed ramus with 1 terminal seta, outer distal margin setose.

Length.—7 mm.; *breadth*, 1·8 mm.

Colour.—In spirit, yellowish.

Locality.—Cape St. Blaize, N., distant 12 miles, 42 fathoms, 4 ovigerous ♀♀. S.S. "Pieter Faure," 22/10/00. (S.A.M., No. A 5957.)

Gen. ARCTURELLA Sars.

Arcturella lobulata n. sp.

Female.—Body glabrous, shagreened, strongly depressed. Head wider than long, antero-lateral processes rounded, with a small point laterally. Eyes large, oval. Peraeon segment 1 with antero-lateral angles acutely pointed; segments 2 and 3 increasing in width, the antero-lateral angles bevelled off obliquely; segment 4 widest, twice as wide (anteriorly) as long, width across anterior margin almost equal to length of head and segments 1-4 together, each antero-lateral angle with two lobe-like processes, the anterior one being more ventral than the posterior one, middle of lateral margin with a shorter lobe; seg-

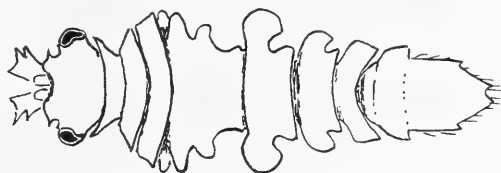


FIG. 3.—*Arcturella lobulata* n. sp.

ment 5 much wider than posterior margin of 4, lobate, with an incision on postero-lateral margin; segment 6 similar but smaller; segment 7 with lateral margins quadrate.

Pleon segments 1-3 increasing in width, 3 projecting laterally, dorsal sutures very indistinct. Telson tapering to a subacute notched apex, with a tooth on each lateral margin.

Antenna 2, 2nd joint with 2 acute teeth on outer margin, 5th joint smooth, flagellum of a single joint, its lower margin with 2 rows of fine setules.

Peraeopods 2-4 moderate, 5th joint of peraeopod 4 reaching a little beyond the eyes.

Peraeopod 5, 2nd joint equal in length to length of peraeon segment 4, but shorter than the rest of the joints together.

Three pairs of marsupial plates.

Length.—10·5 mm.

Colour.—White with fine stellate pink specks over whole body and appendages, eyes dark red.

Locality.—Natal coast, 40 fathoms (H. W. Bell-Marley, 1925), 1 ovigerous ♀. (S.A.M., No. A 6622.)

This pretty species is easily distinguished from all the other species of this genus by its lobulate lateral margins.

Arcturella corniger (Stebb.), var. *subglaber* Brnrd.

1914. Barnard, Ann. S. Afr. Mus., vol. x, pt. 7, p. 211; and 1920, *ibid.*, vol. xvii, pt. 5, p. 392.

A very fine ovigerous ♀ of this form allows me to add some further details to the original description.

The development of the tubercles is much stronger than in the type and corresponds with the greatest development of the tubercles in the typical form of *corniger* (*loc. cit.*, p. 391). There are 4 acute tubercles on the head, one median one on each of the peraeon segments 1–3, of which that on the 1st segment is the largest. The 4th segment has an anterior boss bearing 3 large and 2 small rounded tubercles; 2 acute tubercles on the posterior margin and immediately in front of them a large median obtuse knob. Segments 5–7 each with a single median tubercle.

Length.—17 mm.

Locality.—Mossel Bay, 20 fathoms. (S.A.M., No. A 6624.)

As this locality is situated on the South coast in the warm Agulhas current, my remarks at the end of the original description are beside the point.

I still do not feel justified in raising this form to full specific rank.

FAMILY JAERIDAE.

Gen. JAERA Leach.

See Barnard, Ann. S.A. Mus., vol. x, pt. 11, p. 433, 1914.

Jaera pusilla n. sp.

♂.—Body nearly parallel-sided, inclined to be slightly narrower at the middle of body, with a few scattered setae, chiefly on the lateral margins.

Head without rostrum, anterior margin nearly straight, antero-lateral angles acute, lateral margins minutely serrulate. Eyes oval, composed of 7 ocelli.

Peraeon segments equal, without marked gap between the anterior

and posterior series, without distinct epimera, lateral margins not laciniate, minutely and obscurely serrulate, antero-lateral angles of 1st without strong spines.

Pleon a little longer than broad and longer than last 3 segments, oval, lateral margins minutely serrulate, distal margin slightly convex without median point, postero-lateral angles short and acute.

First antenna with very stout 1st joint, followed by 4 much more slender and gradually diminishing joints.

Second antennae lost.

Mandible and maxilliped as in *J. serrata* Brnrd. (1914, Ann. S.A. Mus., vol. x, pt. 11, p. 433, pl. xxxviii, A), *i.e.* the former with strong molar, the latter with epipod angular on outer margin.

Peraeopods all similar, biunguiculate.

First pleopods stout, lateral margins of peduncles slightly indented,

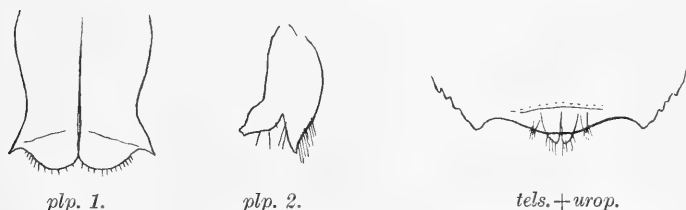


FIG. 4.—*Jaera pusilla* n. sp. First and second pleopods of male : apex of pleon with uropods.

outer apical angles shortly produced in a sharp point, rami broader than long, with setulose apical margins.

Second pleopods small in comparison, peduncle lanceolate, apex acute, setulose, inner ramus situate unusually near apex of peduncle, bulbous, (apparently) without distal filamentous portion, no visible outer ramus.

Uropods small, inserted within the distal margin of pleon, inner rami contiguous, projecting slightly beyond pleon, outer rami smaller, peduncles not distinguishable.

Length.—1.75 mm. ; *breadth*, 0.5 mm.

Colour.—In spirit, whitish, eyes brown.

Locality.—Lion's Head (Cape Peninsula), S.E., distant 22 miles, 95 fathoms, 1 ♂, 6/3/00. S.S. "Pieter Faure." (S.A.M., No. A 5947.)

This species is closely allied to *J. serrata* Brnrd., and is provisionally assigned to the genus *Jaera* on account of the 1st antennae, mandibles, and uropods. The 1st pleopods bear considerable resemblance to those of *J. marina*.

PSEUDOJANIRA g. n.

Similar to *Janira* but with well-developed rostral process (? a projection of the epistome), subchelate 1st peraeopods formed by enlargement of the 6th (not the 5th) joint with nearly transverse palm, eyes well within the lateral margins of the head, and epimera absent.

Although at first sight apparently belonging to the genus *Stenetrium*, and although there is only the one ♀ specimen, the large opercular 1st pleopods show beyond a doubt that this form must be placed in the *Jaeridae*. The expansion of the 6th joint of the 1st peraeopods, instead of the 5th as in *Janira*, necessitates a new genus.

I was not able to satisfy myself whether the rostral process was a projection of the frontal margin proper or of the epistome, but it appeared to be the latter.

Pseudojanira stenetrioides n. sp.

Body rather broad in proportion to length, moderately convex, quite smooth and nonsetose.

Head broader than long, antero-lateral angles sharply pointed and curved forwards but not produced. Frontal margin (? or epistome) produced into a prominent rostrum, apically rounded and set with about 10 spiny points.

Peraeon segments subequal in length, divided though not sharply into an anterior and posterior series, antero-lateral angles of segment 1 pointed but not produced, of segments 2-4 quadrate but not pointed. Postero-lateral angles of segments 5-7 also quadrate. All the peraeopods can be completely withdrawn under the margins of the peraeon.

Pleon subcircular, not longer than broad, side and distal margins evenly rounded and entire.

Antenna 1 with short flagellum of 3 (possibly 4 joints).

Antenna 2 with distinct scale on outer margin of 3rd joint, distal joints and flagellum lost.

Mandibles normal, cutting edge 3-4-dentate, secondary cutting edge in left 3-dentate, spine row with 5 spines in left, 8 in right, molar well developed.

Maxilliped, 2nd joint not elongate (thus different from *Stenetrium*), inner plate about as broad as long, 2nd and 3rd joints of palp only very moderately expanded, not as wide as inner plate, epipod reaching 2nd joint of palp, outer margin not very angular.

Peraeopod 1 resembling that of a *Stenetrium*, 4th joint with upper

apex produced into a spine, 5th short and triangular, 6th subovate, broad, palm straight and nearly transverse, defined by a strong spine and set with several spine-setae, finger matching palm, unguis just overlapping spine at angle of palm.

Peraeopods 2-7 all similar, normal and biunguiculate.

Operculum (first pleopods) subcircular, margin nonsetose.

Uropods inserted on ventral surface of pleon, well within margin,

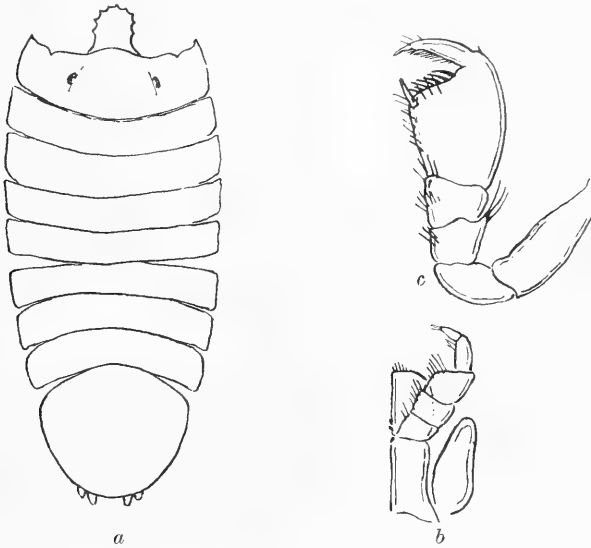


FIG. 5.—*Pseudojanira stenetrioides* n.g. et sp. a, Dorsal view of whole animal; b, maxilliped; c, first peraeopod.

peduncle not visible from above, about as broad as long, rami short, stout, apices obtuse, outer ramus slightly shorter than inner.

Length.—3 mm.; *breadth*, 1.3 mm.

Colour.—Whitish.

Locality.—Zululand coast, in a coral (H. W. Bell-Marley, 1920), 1 ♀. (S.A.M., No. A 6295.)

FAMILY BOPYRIDAE.

Gen. EPIPENAEON Nobili.

1906. *Epipenaeon*. Nobili, Atti. Ac. Sci. Torino, vol. xli, p. 3.

1910. „ Thielemann, Abh. K. Ak. Wiss. München, II, Suppl., Bd. 3 Abh., p. 79.

Epipenaeon japonicum Thielemann.

1910. *Epipenaeon japonica*. Thielemann, *loc. cit.*, p. 79, pl. ii, fig. 31, text-figs. 86, 87.

A male and female agreeing in all essentials with Thielemann's description.

The front margin of the head and the outer margins of the epimeral plates (2 on the left and the anterior 4 on the right side) irregularly crenulate. The 6th pleon segment is quite obsolete in dorsal view.

Length.—♀ 16 mm., ♂ 4.25 mm.; *breadth*, ♀ 12 mm., ♂ 1.5 mm.

Locality.—Delagoa Bay (Dr. Gilchrist, July 1919). In the right branchial cavity of *Penaeopsis monoceros* Fabr.

Geogr. Distribution.—Japan, on *Penaeus* sp. (Thielemann).

FAMILY CABIROPSIDAE.

1895. *Cabiropsidae*. Giard and Bonnier, Bull. Sci. Fr., vol. xxv, pp. 421, 441, 443.

1920. „ Caullery and Mesnil, Bull. Biol., vol. liv, fasc. 1, p. 1.

1920. „ Barnard, Ann. S. Afr. Mus., vol. xvii, pt. 5, p. 431.

Sars (1899, Crust. Norw., vol. ii, p. 231) and Hansen (1916, Dan. Ingolf. Exp. Crust. Malac., vol. iii, No. 5, p. 212) do not separate this family from the *Cryptoniscidae*. Hansen (*loc. cit.*, pp. 214, 216) describes two new genera and Caullery and Mesnil have recently described another.

This family, all the members of which are parasitic on other Isopods, comprises the following genera :—

<i>Cabirops</i> Kossm., 1884,	parasitic on	<i>Bopyridae</i> .
<i>Clypeoniscus</i> G. & B., 1895,	„	<i>Idoteidae</i> and <i>Stenetriidae</i> .
<i>Munnoniscus</i> G. & B., 1895,	„	<i>Munnopsidae</i> .
<i>Seroloniscus</i> G. & B., 1895,	„	<i>Serolidae</i> .
<i>Gnomoniscus</i> G. & B., 1895,	„	<i>Podascon</i> , a parasite on Amphipods.
<i>Arcturocheres</i> Hans., 1916,	„	<i>Astacillidae</i> .
<i>Astacilloechus</i> Hans., 1916,	„	„
<i>Ancyroniscus</i> C. & M., 1920,	„	<i>Sphaeromidae</i> .

To these it is now necessary to add a ninth genus parasitic on

another family of Isopods: the *Aegidae*. It is regrettable that the male is unknown, but the form of the adult female is sufficiently distinctive.

AEGONISCUS n. g.

Body of adult female ovoid, the lateral portions swollen into 6 large bilobulate ovigerous lobes, extending nearly from the medio-dorsal line to the medio-ventral line, completely hiding the ventral surface with its 6 pairs of valvular lamellae. No caudal projection. No fixing apparatus.

Aegoniscus gigas n. sp.

Ovoid nearly symmetrical, 23 mm. long, 16 mm. broad, and 10 mm. deep. Dorsal surface mutilated so that the shape and position of the opaque area is not discernible, the lateral ovigerous lobes, however, nearly reaching the middle line. Ventral surface completely hidden by the lower divisions of the lateral lobes, with 6 pairs of valvular lamellae. At the anterior end, hidden under the 1st pair of lateral lobes, is a pair of low bilobulate projections probably representing the

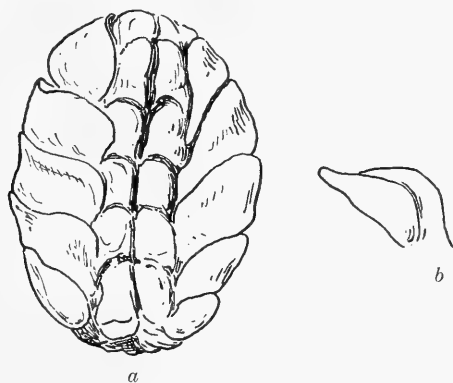


FIG. 6.—*Aegoniscus gigas* n.g. et sp. a, Ventral view, $\times 2$; b, first pereopod, left side.

2 pairs of antennae, and behind these the short, papilliform, unjointed, and apically acute 1st pereopods.

The specimen was found in the brood-pouch of an *Aega semicarinata* Miers (described in Ann. S. Afr. Mus., vol. x, pt. 11, 1914, as *urotoma* Brnrd.; determination emended, *id.*, *ibid.*, vol. xv, pt. 3, 1916), measuring 53 mm. in length. The parasite almost completely filled

up the brood-pouch in which a few shrivelled eggs of the host still remained (*cf.* Caullery and Mesnil, *loc. cit.*, pp. 34, 35).

The eggs of the parasite measure $\frac{1}{9}$ mm., so that when the lateral lobes are full the number of eggs produced must be enormous.

Locality.—Off Cape Point, 180 fathoms. (S.A.M., No. A 6313, No. of host, 150971.)

R			T		
		PAGE			PAGE
<i>retusa</i> (Cteatessa) . . .		393	TANAIDAE . . .		382
<i>rhabdota</i> (Nerocila) . . .		390	Tanais . . .		381
			tricarinata (Haliophasma) . .		385
S			U		
<i>savignyi</i> (Leptochelia) . . .		382	uncinatus (Antias) . . .		381
<i>serra</i> (Nerocila) . . .		392			
<i>setosa</i> (Arcturella) . . .		381	Z		
<i>similis</i> (Antarcturus) . . .		395	<i>Zenobia</i> . . .		393
<i>spongicola</i> (Tanais) . . .		381	<i>Zenobiana</i> . . .		393
<i>stenetrioides</i> (Pseudojanira) . .		406			
<i>subglaber</i> (Arcturella corniger var.)		404			

ANNALS OF THE SOUTH AFRICAN MUSEUM

VOLUME XX.

PART VI, containing:—

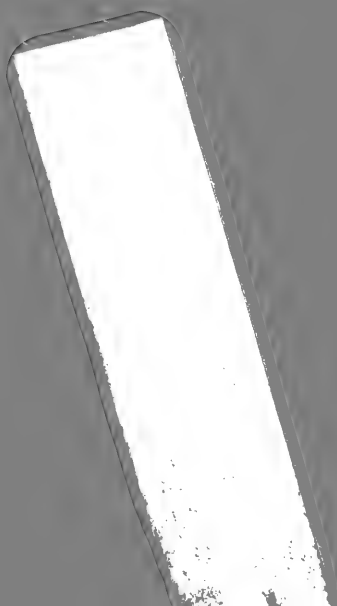
11. *Descriptions of New and Little-known Lizards and Batrachians from South Africa.* By JOHN HEWITT. (With Plates XXXV-XXXVII, and 9 Text-figures.)
12. *Some Field Notes on the Batrachia of the Cape Peninsula.* By WALTER ROSE, L.D.S., R.C.S.Eng. (With Plate XXXVIII, and 8 Text-figures.)
13. *A Monographic Revision of the Genus Breviceps, with Distribution Records and Descriptions of New Species.* By J. H. POWER, F.Z.S. (With Plates XXXIX-XLIII.)
14. *Some New or Little-known Reptiles and Batrachians from South Africa.* By JOHN HEWITT. (With Plates XLIV and XLV.)
15. *Some Notes on the Lizards of the Cape Peninsula.* By WALTER ROSE, L.D.S., R.C.S.Eng.

Title Page and Index to Volume XX. *from the ...*



ISSUED JULY 1926. PRICE 4s. 6d.

PRINTED FOR THE
TRUSTEES OF THE SOUTH AFRICAN MUSEUM
BY NEILL AND CO., LTD.,
212 CAUSEWAYSIDE, EDINBURGH.



11. *Descriptions of New and Little-known Lizards and Batrachians from South Africa.*—By JOHN HEWITT.

(With Plates XXXV-XXXVII and 9 Text-figures.)

Rhoptropus barnardi sp. nov.

(Plate XXXV.)

Types.—Four adult specimens and two juveniles in the collection of the South African Museum (No. 16639), taken near Eriksson's Drift, Kunene River, by Messrs. K. H. Barnard and R. F. Lawrence, 1923. The species is appropriately named after Dr. K. H. Barnard, widely known through his important works on the Crustacean fauna of South Africa.

This species is nearly related to *R. afer* Ptrs., which was collected somewhere in Damaraland by Wahlberg, but is at once distinguished therefrom by the pointed snout, the well-marked row of chin-shields, and probably also by the segmented tail.

Head a little flattened, shallowly concave between the orbits; snout elongate and depressed but rather sharply pointed, canthus rostralis absent, nostril pierced in the centre of a rounded swelling formed by three nasal scutes, the two swellings only a granule apart; behind this swelling the side of the snout presents a distinct depression; rostral scale with upper margin shaped like an inverted flattened V, having a short median prolongation between the nasal swellings; scales on the snout larger than those on the middle of the back, and considerably larger than those on the occiput; the largest scales are situated immediately in front of the orbit superiorly, and they are keeled; about 12 upper labials and about 8 lower labials; mental and first two lower labials on each side much elongated, and adjoining these in a transverse line are 6 chin-shields which are considerably larger than the granules following them posteriorly, the line of enlarged shields extending also for some little distance obliquely backwards on each side of the gular region; eyelid incomplete as a granular fold, ventrally and postero-ventrally, its scales being granular dorsally but larger and flattened anteriorly. Dorsal surface of body with

more or less rounded granular scales, which are often very faintly keeled or tubercled; ventral surfaces with flattened scales which for the most part are not imbricate, but on the throat and sternal region are more or less sub-imbricate; the larger ventral scales are sub-hexagonal, and their posterior borders are very faintly crenulated (when examined under a compound microscope), this crenulation being traceable even in some of the gular scales; in front of the vent, two groups of 3 preanal pores with a single simple scale intervening, or 7 pores in a continuous line.

Tail depressed and segmented, the first segment being well distinguished by a deep lateral constriction at its junction with the second; weaker lateral constrictions are also traceable between the several immediately succeeding segments, but more distally the segmentation is only conspicuous ventrally; along the greater portion of the mid-ventral region there is a double row of enlarged scales, each segment, except towards the base of the tail, having 3 pairs of such scales, the hindermost pair of each segment being the largest; dorsally all the caudal scales are granular, arranged in transverse lines. Thirteen segments occur in one specimen, the remaining third of the total length being probably reproduced; it is thin and slender, tapering to a fine point. One specimen has a reproduced tail, the break having taken place at the junction of the second and third segments. In this specimen the new tail is unsegmented, having granular scales above but ventrally along the midline a single row of enlarged scales which are much elongated transversely.

Digits free, first toe well developed, third extending a little beyond the fourth. An enlarged flat nail-like distal scale on each digit superiorly, but no retractile claw; instead of the claw, a small triangular scale immediately succeeds the above-mentioned nail-like scale. Upper surface of each digit otherwise with small scales, which enlarge somewhat over the digital expansion. Eight transverse lamellae below the expansion of the digit, or 6-7 on the shorter toes. The most distal lamella divided in the middle. A row of enlarged scales along the midline of the digit inferiorly, 8 or 9 on the longer toes, the basal scales being largest, only 4 or 5 on the shortest toe.

Colour of Spirit Specimens.—Above greyish with black spots sparsely arranged; these spots are absent or very small on the head; lower parts whitish.

Measurements of No. 16639.—Total length, 84.5 mm.; from snout to vent, 41 mm.; from snout to ear-opening, 11 mm.; fore-limb, 17 mm.; hind-limb, 23 mm.

Another specimen, very slightly larger but lacking the tail, measures 10.5 mm. across the throat at the angles of the jaw ; from orbit to tip of snout, 5.5 mm. ; from snout to vent, 43 mm.

Only two other species were recognised by Boulenger in his Revised List (1910), one of which, *ocellatus* Blgr., was recorded from Cape-town, no doubt erroneously. A third form seems to me worthy of recognition, *braconnieri* Thom., judging from the description. The 3 chin-shields and the back covered with small hexagonal scales seem to indicate a well-marked form.

Since writing the above, I have seen further specimens from Kamanyab, Kaokoveld, S.W.A. (R. F. Lawrence, 1925, S.A.M., No. 17262). These agree with the types in the shape of the snout, of the mental shield and lower labials ; but in one immature example the chin-shields are only a little bigger than the adjoining scales ; and in the largest example the small triangular scale at the distal end of the digit superiorly is not in any way marked out from the neighbouring scales. The measurements of the latter specimen are : from snout to vent, 61 mm. ; from end of snout to ear-opening, 17 mm. ; breadth of head, 15 mm.

Oedura tembulica sp. nov.

This new species, first discovered by Mr. Robert Essex, is described from a series of specimens collected at Cofimvaba, in Tembuland, by Mr. C. W. Wilmot (May 1925). The species is entirely rupicolous, inhabiting the cracks between sun-split rocks on a hillside.

It is a stout form, closely related to *O. amatolica* mihi (Records Albany Museum, vol. iii, p. 350, 1925), but distinguished therefrom by the following characters :—

(a) Digits inferiorly without very broad scales along the median line, excepting the most distal scale, which is greatly elongated transversely. In a large female the condition is as follows : The first toe (shortest) has two pairs of adhesive plates at the distal end of the basal portion, but on this toe one of them is ill developed ; besides the distal scale—which adjoins the smaller adhesive plate—there is only one other enlarged scale inferiorly. The second toe has 2 enlarged scales in addition to the distal one, these two being broader than long. The third has 4 or 5 enlarged scales besides the distal one, and the fourth 3–5 oval scales ; these toes are more slender than the rest. Fifth toe with infero-median scales quite like those on the outer side of the toe. Toes II–IV with small scales inferiorly in their basal

portions. In the male there is a similar condition, but the enlarged subdigital scales are rounded rather than oval, the distal one excepted.

(b) Males with 6-9 preanal pores in a curved line, and an oblique row of 3 tubercles at the base of the tail on each side of the vent, the uppermost much the largest.

(c) Dorsal scales of body granular, sometimes rather pointed, not well flattened and imbricate as in *amatolica*.

Chin-shields small. The mental shield is rather elongated and narrows much towards the apex, where it is considerably narrower than the adjoining first labial. The first labial is also elongated, being longer than broad (in *amatolica* as broad as long). In one adult male specimen the rostral is separated from the left nostril by a small granule, but enters the right nostril. The supraciliary scales in the postero-dorsal part of the orbit are elongated and sharply pointed; there are generally 5 or 6 such scales, the most posterior one largest. The other scales belonging to the same row are small.

The tail is somewhat flattened and segmented by faint lateral constrictions throughout its length; about 20 segments are recognisable in the tail of an immature specimen, but in most adults the tail is reproduced. This segmentation is not, or hardly, noticeable in dorsal view, and the dark markings on the upper surface have no relation with the segmentation. Neither is there any modification in the size or shape of the scales at the junction of the segments above or below. Dorsally, a segment includes 7 rows of scales, but ventrally only 4 rows.

Colour of Spirit Specimens.—Above greyish, with indefinite blackish markings. Sometimes there are indications of irregular cross-bands on the back, but generally the markings on the back, if present at all, are irregular mottlings; on the tail there are dark cross-markings and spots at intervals.

Length from snout to vent, 56 mm.; breadth of head, 13 mm.

The genus *Oedura* has been regarded as a great rarity in South Africa, and undoubtedly such is actually the case in most parts of the country. However, recent explorations, especially by Mr. R. Essex, have served to reveal it as common at certain isolated spots. These are usually, but not always, on inland mountains at high elevation. Each of these haunts seems to be the home of a peculiar form, and there is at present no evidence that any one form is widely distributed, as is the case in the genus *Pachydactylus* and various other geckoes.

Tetradactylus bilineatus sp. nov.

Type.—A single specimen taken in the Burghersdorp district, C.P., by Dr. R. Broom, who presented it to the Albany Museum.

The species is related to *T. tetradactylus* Lacep., but is distinguished therefrom on the following characters :—

(a) The nostril is bordered only by 3 nasal scales, the lowest one of which is elongated. Thus the first labial does not enter the nostril, as is the case in *tetradactylus*, and indeed in all known species, 2 nasals being the rule in this genus.

(b) The frontal scute is broader, being about twice as long as broad, whereas in *tetradactylus* it is $2\frac{1}{2}$ times as long as broad, or even longer.

(c) Third finger considerably longer than the second: in *tetradactylus* it is only slightly longer than the second, or subequal thereto.

(d) Hind-limbs relatively longer, extending backwards as far as the ninth row of caudal scales; in *tetradactylus* only extending as far as the sixth or seventh row. The fore-limb extends backwards over 9 rows of ventral scales: in *tetradactylus* over 8 ventral rows.

There are 63 rows of scales from the occiput to the base of the tail. Femoral pores 4-5. On each side of the vent is a pointed claw-like scale.

Head scales with dark brown spots. A conspicuous dark brown dorso-lateral stripe on each side of the body. These stripes are three scales apart, the two middle scales of each transverse row on the back being devoid of pigment, but the scale lateral thereto being pigmented in its outer half.

Length from snout to vent, 53 mm.; hind-limb, 9 mm.; fore-limb, 7 mm.; tail incomplete.

Bufo rosei sp. nov.

(Plate XXXVII.)

This species is based on a series of specimens collected by Mr. Walter Rose on Muizenberg Mountain during March 1925. It is a very small form, which has hitherto been overlooked, perhaps owing to confusion with the young of *angusticeps*.

The characters of *rosei* are: head broad, snout short, rounded, and not projecting; interorbital space a trifle narrower than the upper eyelid or subequal thereto; vertebral line absent or extremely indistinct; tympanum absent; pupil horizontal, but short outgrowths of the iris in the middle make it somewhat dumb-bell shaped; parotoids not prominent but easily distinguished on account of their

reddish tinge, sometimes much flattened and nearly obsolete, usually separated from the orbit by a considerable space. Dorsal surfaces throughout often quite smooth, without granules, asperities, or warts; sometimes with fairly numerous flattened smooth blister-like warts dorsally and laterally, but such blisters do not generally extend to the head; they are best developed on the sides of the body, several larger ones more or less in a line with the parotoids being faintly tinged with red. Just behind the angle of the mouth there are one or several such excrescences, which also may be red-tinged, and are essentially similar to the parotoids in structure. Throat and belly quite smooth. In front of the vent there is a large subcircular area over the fat bodies, where the skin is strongly corrugated. First finger subequal to the second, or even very slightly longer. Toes without web; a small inner metatarsal tubercle, outer one very weak; subarticular tubercles rather weakly or moderately developed, showing signs of doubling on the longer digits; toes slender, cylindric, and rather long, the first being well developed; tarsal fold wanting. The hind-limb being carried forwards along the body, the tarso-metatarsal articulation reaches to a point between the parotoid and the orbit, or to the middle of the eye.

Dorsally dark grey, with more or less distinct indications of three pale stripes; the mid-dorsal stripe may extend from the tip of the snout to the vent; the lateral stripes extend backwards from the red-tinged parotoids to the inguinal region; besides, the dorsal surface has numerous inconspicuous black spots or blotches of varying shape and size, more or less symmetrically disposed; sides of body marbled with black and pale grey, sometimes with white spots below; throat white, belly dirty white and sometimes with faint dark markings, the corrugated area over the fat-gland tinged with yellow. Sometimes the three dorsal stripes are broken up or obsolete, at other times conspicuous.

Length from snout to vent, 25 mm.

This small toad, though differing greatly from a typical *Bufo* in its soft skin and dorsal striping, is clearly referable to the group of Cape species including *angusticeps*, *amatolica*, and *gariensis*. These all have the belly skin more or less smooth, but the dorsal surface may be nearly smooth or covered with asperities even in specimens from the same locality (*gariensis* at Victoria West). A peculiar character of all of them, but only feebly represented in *regularis*, is the projection of the iris at its middle point above and below, producing a dumbbell-shaped pupil.

The absence of the tympanum is a special character of *rosei*, which separates it from any of these species, although *angusticeps* may have an indistinct tympanum. The latter species has the inner metatarsal tubercle much more strongly developed, and the toes are all more or less fringed with web, so that they are characteristically flattened over the greater portion of their length and pointed at the tip; the innermost toe is thus subtriangular rather than cylindric, as in *rosei*.

In the soft skin and comparatively feeble development of the pedal tubercles, *rosei* resembles the Cameroon species, *B. preussi* Matschie, but perhaps only superficially; and the latter seems easily distinguishable on the webbing of the feet (see F. Nieden's detailed account of the genus in his work, *Anura I, Das Tierreich* (46), Berlin and Leipzig, 1923).

Three species of *Bufo* are now known from the neighbourhood of the Cape Peninsula—*regularis*, *angusticeps*, and *rosei*; a fourth (*granti*) was once recorded from Durban Road by Mr. Boulenger; but this record may be regarded with suspicion, inasmuch as the species has not been taken by the local collectors in that district and is, moreover, essentially a Karroo type. When expressing his suspicion of that record, Mr. Rose wrote to me as follows: "We live within gunshot of the Durban Road, and have gone over that region with a fine comb, day and night, wet and dry, and have probably turned over every log, stone, or tin within miles. I think it is reasonable to suppose that *B. granti* is not found in our neighbourhood at all. I am inclined to think that the same applies to *Rappia marmorata* and *Megalizalus spinifrons*, of both of which a solitary specimen is reported from near our home."

I have drawn attention to these doubtful records from the Cape Peninsula on a previous occasion, but published records are apt to survive a long time, stultifying our distribution studies.*

* I take this opportunity of referring to Dr. Noble's most useful check-list of the Amphibia of Africa,† the first that has been published, at any rate within recent decades. Most workers on the South African fauna will understand that the stated range of many frogs and toads as "South Africa" is not to be taken too literally, for actually not a single species can be said to occur throughout our region, with the possible exception of *Xenopus laevis*. Some species of very wide distribution in the warmest parts of Africa, such as *Rana angolensis* and *Bufo regularis*, range throughout all the northern half of our region, and southwards far into the Eastern Cape Province, but are replaced by other species throughout the greater portion of the western half of the Cape. Other widespread species, such as *Rana adspersa*, *R. oxyrhynchus*, *Phrynomantis bifasciata*, and *Hemisus*

† Bulletin, American Museum Nat. Hist., vol. xlix, pp. 147-347, 1924.

The absence or weak development of the tympanum is a character peculiar to various species of Batrachians inhabiting the Cape Peninsula, e.g. *Bufo rosei*, *Microbatrachus capensis*, *Arthroleptella lightfooti*, *Cacosternum capense*, *Breviceps gibbosus*, *Rappia horstockii*, and *Heleophryne rosei*. This seems best interpreted as a primitive condition, and that of *Rana*, etc., as secondary.

MICROBATRACHUS gen. nov.

Related to *Cacosternum* Blgr. and *Anhydropfryne* Hwtt., but differing therefrom in the presence of precoracoid and omosternum. Sacral diapophyses strongly dilated, definitely of the Engystomatid type. Cranium without frontoparietal fontanelle; maxillary and premaxillary teeth present, but no vomerine teeth; outer metatarsals slightly separated by web distally. Pupil horizontal.

Genotype.—*Phrynobatrachus capensis* Blgr.

Microbatrachus capensis (Blgr.).

(Plate XXXVI, figs. 5 and 6. Text-fig. 3.)

Ann. S. Afr. Mus., vol. v, p. 538, 1910.

Mr. Rose has taken a series of specimens of this interesting species, which at present is only known from shallow pools on the Cape Flats. The distribution is apparently very restricted, although the species is quite abundant in those pools.

The degree of dilation of the sacral diapophyses is a character of doubtful importance in the separation of families, yet there is good generic value therein; and on this character alone *capensis* cannot be included in the same genus with *Phrynobatrachus* or with

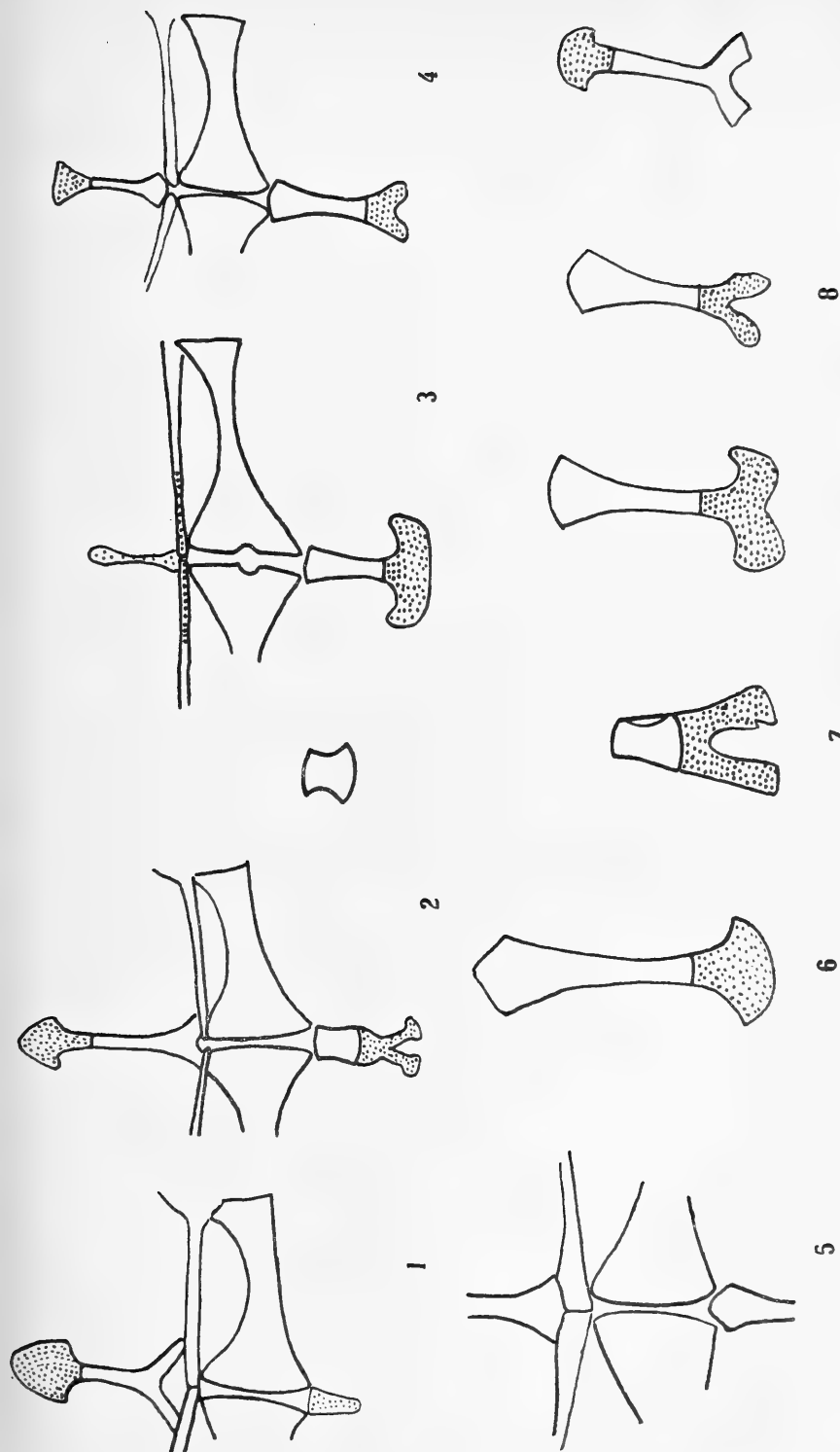
guttatum, are altogether unrepresented in the Western Province. The two last mentioned are recorded respectively in the check-list as "South Africa northward to Angola in the west, to northern Kenya Colony in the east," and "South Africa north to Southern Angola and Zululand." I have mentioned these facts in order to emphasise that we think it no longer sufficient to treat South Africa as a homogeneous area. It is preferable to list each of the various provinces separately, as in the recently published "Systema Avium Ethiopicarum" of W. L. Sclater, or at least to indicate the southern limits of each species. This would reveal the peculiarities of the western Cape fauna; even in the well-watered regions of the southern coast, this part of South Africa has a very small Amphibian fauna compared with that of Natal, for instance. In actual size it is certainly an insignificant portion of the great continent, but its fauna has a very special interest to students of zoogeography.

Corrigendum, p. 420 *et seq.*

For MICROBATRACHUS *read* MICROBATRACHELLA, the former name
being preoccupied (Roux, 1910).

Annals S.A. Museum, Vol. XX, Part 6.





FIGS. 1-8.

Pectoral apparatus in (1) *Arthroleptis vahlbergi* Smith; (2) *Phrynobatrachus natalensis* Smith, female example, with bony metasternum of a male on the right; (3) *Microbatrachus capensis* Bler., showing feebly ossified omosternum and ventral half of precoracoid cartilagenous; (4) *Arthroleptella bicolor* sp. nov., —the shape of the bony metasternum is somewhat variable, being in some specimens almost of the same breadth throughout; (5) *Arthroleptella tighifudi* Bler.; (6) elastrum of another specimen of *tighifudi*; (7) metasternum of *Phrynobatrachus plicatus* (Gthr.); (8) two metasterna and omosternum of *Nalobatrachus bouchebergi* Hewitt and Methuen—omosternum in some specimens not distinctly λ-shaped.

Natalobatrachus, which are of the Ranid type. The diapophyses of *capensis* are more enlarged than those of *Anhydrophrène*.

The shoulder girdle (text-fig. 3) also differs from that of *Phrynobatrachus*; the omosternum and precoracoid seem to be in process of degeneration, the former being only feebly ossified and the latter being purely cartilaginous in its ventral portion; the expanded ventral end of the coracoid has a weakly ossified area in the middle, and thus it appears to be double-headed, as in *Cacosternum capense* mihi (Records Albany Mus., vol. iii, p. 367, pl. xv): the metasternum is a strong bony rod and carries a broadly expanded cartilaginous plate.

In the pedal characters there is only superficial resemblance to *Phrynobatrachus*. No trace of a tarsal tubercle occurs, and there is only one metatarsal tubercle. The outer metatarsals are only slightly separated by web, rather less so than in *P. natalensis*. The digits are long, slender, and finely tapering. Terminal phalanx rather long and slender, but swollen at the tip, and tending to become anchor-shaped. Tongue bifid behind. Tarso-metatarsal articulation of adpressed hind-limb reaching the eye in females, midway between the eye and end of snout in adult males. Surfaces without warts, granulations, or asperities; no granulation under or behind the thighs. Body not depressed, snout short, rounded, or slightly pointed in male; latter paler than female, third finger as in female or a trifle longer, first finger swollen and modified as in *Cacosternum*, a sub-gular vocal sac.

The colour pattern is distinctive: a black and white reticulation on the belly; throat either pale, or dark with irregular white spots; a few very fine white spots may also occur on the lower surfaces of the limbs, but generally not so; dorsal surface with small dark spots and sometimes a continuous white mid-dorsal streak; an oblique dark stripe from the eye to the base of the fore-limb. In life "the colouring shows an unlimited range, greens and olives predominating, and even red ones occurring; the power of colour-changing seems great, the rest colour being olive brown" (W. Rose).

The characteristic ventral coloration has considerable resemblance to that of *Anhydrophrène*, and, to a less extent, to *Cacosternum*.

Microbatrachus is of much phylogenetic interest. Firstly, it represents the progenitor of the two more specialised genera just mentioned. It is, moreover, the simplest of all the African Engystomatids, occupying a position comparable to that of *Heleophryne* amongst the Bufonids. These three allied genera constitute an isolated group not directly connected with typical Engystomatids

such as *Phrynomantis*, but possibly ancestral thereto. On the other hand, the variation of the sacral diapophysis character is such that this group is easily connected up through *Anhydrophtyrne* with primitive Ranids, so that there may even be remote relationship with *Phrynobatrachus*. The affinity with *Anhydrophtyrne* is also noteworthy as a further instance of connection between the faunas of the South-west Cape and of the Amatola region.

Several very young frogs and tadpoles supplied by Mr. Rose enable me to give some notes on the larval characters. The two oldest tadpoles (text-fig. 9, *b*) are in the stage with the hind-limbs well emerged and fore-limbs still hidden. There is a pair of well-developed and

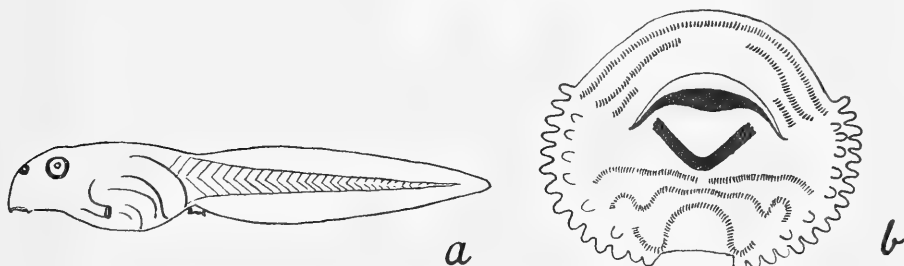


FIG. 9.—*Microbatrachus capensis* (Blgr.). *a*, early tadpole in side view, enlarged. *b*, oral apparatus of late tadpole: it is stretched out antero-posteriorly to expose the jaws. In earlier stages the lateral papillae are longer.

black horny jaws; they are rather widely extended, and the cutting margin of the upper jaw is sinuous, with a broad convexity in the middle as a beak. Three upper and three lower tooth-rows, all conspicuous but single; in the upper series, only the outermost one is complete and the innermost one is much reduced; the lower series has three well-developed rows, all somewhat sinuous or folded into curves, and the inner one is incomplete mesially. Mouth disc large, transversely elongated and ventral. Lateral lobes edged with papillae, two rows of which are more or less developed. Nostrils rather large, their distance apart about $2\frac{1}{2}$ –3 times the long diameter of a nostril.

Body of moderate proportions, neither very deep nor depressed. Tail crests not deep, the margin above and below only lightly curved, tapering gradually to the end, which is acute; greatest depth of tail at any point scarcely, if at all, exceeds that of the body. Spiracle not distinctly traceable in the specimens. Left fore-limb emerges before the right one. Upper surfaces generally rather feebly infuscated;

no dark spots on tail or body. Sometimes a white mid-dorsal streak on head and body. Lower surfaces of body and limbs whitish, the coils of the intestine being invisible through the opaque belly skin.

Total length, 25 mm.; tail, 18 mm.

At a somewhat later stage the dorsal surface of the juvenile frog shows numerous characteristic ocelli with small white centres and broader blackish margins; the ventral surfaces remain an opaque white without blackish markings.

In tadpoles at an earlier stage (text-fig. 9, *a*), with the hind-limb just protruding, the spiracle is easily seen; it is situated ventro-laterally, the elongated tube being directed straight backwards but not dorsalwards. The tooth-rows are much like those of older specimens, but are not so much folded; the innermost row of the upper series may be entirely obsolete, but, on the other hand, the innermost row of the lower series may be unbroken mesially; the outermost lower row may be less than $\frac{1}{2}$, and at any rate is not more than $\frac{2}{3}$, the length of the middle lower row. Eyes rather large. Nostrils prominent, their distance apart being about half that between the orbits. Anus opening on right side of base of caudal fin, close to its lower edge. Breadth of body greater than its depth. Seen from above, the outline of head and body is ovate. Integument transparent, the few coils of the intestine clearly visible. No black spots or streaks, but there are innumerable very minute granules of melanin in the skin; these are fairly generally distributed, but are absent or ill developed over the otic region on each side of the head, over the hinder part of the belly mesially, and over the throat region. Upper caudal crest commencing at a point only slightly anterior to the vertical of the vent, considerably posterior to the vertical of the spiracle. Tail tapering towards the tip, where it is pointed but not acutely so; in shape it is more or less elongate hastate, being about $1\frac{1}{2}$ – $1\frac{2}{3}$ times the length of head and body combined; the exact shape varies, being sometimes tapering more or less uniformly from base to tip, at other times deepest about the middle of its length.

The dentition of the tadpole has considerable resemblance to that of *Cacosternum*; however, in the latter, the whole of the lower lip is fringed with papillae as at the sides, there may be traces of a fourth upper row of teeth, the outermost lower row is better developed, also the oral disc is smaller than that of *Microbatrachus*. The spiracle in *Cacosternum* is not quite so ventrally situated and its tube is directed obliquely upwards.

In the arrangement of the tooth-rows and of the fringing papillae,

Microbatrachus tadpoles resemble *Bufo*. This, however, is possibly a result of convergence, for in the position of the anus the two seem well separated. The anal character is suspected to be of importance because of a certain constancy in genera which show considerable variation in the dentition arrangement; on this character, *Bufo* and *Heleophryne* agree together, although differing greatly in the mouth parts.

In an important paper on Indian tadpoles (Records of the Indian Museum, vol. xv, pt. i), Annandale and Narayan Rao state that it does not seem possible (except in the case of *Oxyglossus*) to distinguish the larvae of the different genera of this family, the Ranidae. To realise the great diversity in structure that may occur amongst tadpoles of the same genus, *Rana*, it is only necessary to consult Annandale's previous paper on South Indian tadpoles (see Records of the Indian Museum, vol. xv, pl. i).

Nevertheless, the above-mentioned authors indicated certain family differences amongst the tadpoles of the Indian plains. In the Engystomatidae of India there is no mouth-disc, no horny teeth or beak, and the spiracle is in the midventral line. On the characters given by these authorities, *Cacosternum* and *Microbatrachus* would exactly fit in with the Ranidae.

Natalobatrachus bonebergi Hewitt and Methuen.

Trans. Roy. Soc. S. Afr., vol. iii, p. 107, 1913.

Dr. G. K. Noble has on several occasions pronounced this species to be nothing more than a *Phrynobatrachus*. A relationship to that genus was indeed indicated by Methuen and myself when we proposed the new generic name of *Natalobatrachus*. At that time we were chiefly impressed by the T-shaped distal phalanges as a distinguishing character from *Phrynobatrachus*. A recent investigation of the pectoral girdle (see text-fig. 8) has again satisfied me that generic separation is well justified. The metasternum of *bonebergi* is quite different from that of *P. natalensis*; the bony portion is a long rod greatly widened in front and tapering behind. The precoracoid is strong and bony. Here I may remark that Noble's figures of the pectoral girdle of this species, and probably of others, do not correctly represent some of the characters concerned, presumably because of alteration in the skeletonising process. The drawings I now give are based on simple dissections.

It is clear, as Noble points out, that *bonebergi* is closely related to

the Congo species described by Boulenger as *Arthroleptis dendrobates*, and now called *Phrynobatrachus dendrobates* by Noble. But I cannot agree that it is also closely allied to *Phrynobatrachus plicatus*, as he asserts. The metasternum of *plicatus* (text-fig. 7) is definitely of the *Phrynobatrachus* type. In some genera the metasternum is certainly very variable, but at least an occasional importance of this character is revealed by an examination of the metasternum in various South African species of *Rana*. These prove to be essentially similar, although there are specific differences. Even such widely different frogs as *Rana delalandi* and *R. fasciata*, which are still referred to distinct genera by eminent authorities, show much resemblance in their metasterna.

For the present therefore, and until intermediate conditions are discovered, *Natalobatrachus* should be employed for the reception of the two species, *bonebergi* and *dendrobates*. Externally, it considerably resembles those species of *Phrynobatrachus* which have discs at the tips of the digits, but its discs are broader, the body more slender, and the tarsal tubercle obsolete or indistinct; also, the males are quite devoid of external subgular vocal sacs.

It seems probable that the presence of an elongated median papilla on the tongue is also of generic importance; it occurs in *natalensis*, *perpalmatus*, and *plicatus*, but is wanting in *bonebergi*. It may be added that in the most recent revision of the genus *Phrynobatrachus*, that by de Witte (Revue Zoologique Africaine, vol. vi, fasc. 2, 1919), *bonebergi* and *dendrobates* are not included; on the other hand, *capensis* is admitted, the author remarking that this is the only species of *Phrynobatrachus* that lacks a tarsal tubercle, his notes on *capensis* being based solely on the original description, which we now know to be very incomplete.

ARTHROLEPTELLA gen. nov.

Resembling *Arthroleptis* (Smith) in most of its characters, but differing in the characters of the pectoral girdle. In *Arthroleptis* the omosternum is λ -shaped and well developed, being much larger than the metasternum, which is cartilaginous: in *Arthroleptella* the omosternum is entire, and somewhat smaller than the metasternum, which has a well-developed bony rod. Sacral diapophyses typically Ranid, scarcely dilated at the apex.

Genotype.—*Arthroleptis lightfooti* Blgr.

The shoulder girdle of *Arthroleptis* and related genera has been studied by Dr. G. K. Noble, who furnished a useful series of illustra-

tions in his paper on the Herpetology of the Belgian Congo (Bulletin American Mus. Nat. Hist., vol. xlix, pp. 143-347, 1924). His account, however, somewhat discredits the value of this character as a basis for generic distinction. He even tells us that the girdles of *A. wahlbergi* and *P. natalensis*, the type species of *Arthroleptis* and *Phrynobatrachus* respectively, are identical. Now, such is by no means the case. *A. wahlbergi* (text-fig. 1) has a distinctly λ -shaped omosternum, and the short cartilaginous metasternum tapers behind; the precoracoid is a strong bony rod. There is no bony style to the sternum, as is wrongly asserted in the Brit. Mus. Cat. *P. natalensis* (text-fig. 2) has also a long well-developed omosternum, triangularly expanded at the base, but not definitely λ -shaped; it has a broad and strong, but rather short, bony metasternum, a little constricted in the middle, and sometimes broadest distally, and there is a bifid cartilaginous xiphisternum; the precoracoid is very slender and cartilaginous or feebly ossified. These two girdles are easily distinguishable, and it is quite clear from Noble's figures that the two types are of considerable stability; *A. wahlbergi* of Natal seems indistinguishable in its girdle from *A. batesii* of Cameroon, from *A. variabilis* of Cameroon, and from *A. xenodactylus* of Tanganyika. *P. natalensis* again is matched precisely in its pectoral girdle by *P. perpalmaris* of Lake Moero.

Arthroleptella lightfooti (Blgr.).

(Plate XXXVI, figs. 1-4, 8, and text-figs. 5 and 6.)

Ann. S. Afr. Mus., vol. v, p. 538, 1910.

Mr. Rose has collected this species at various localities in the Cape Peninsula, viz. from Skeleton Gorge and Devil's Peak Gorge on Table Mountain, from Muizenberg Mountain, and from Silvermyn Valley near Fish Hoek. As I learnt five years ago from Mr. Barnard, and more recently from Mr. Rose, this little frog dispenses with the free-swimming tadpole stage, like *Anhydrophyrne* and *Breviceps*. "During November I found several small clusters of eggs, about five eggs in each cluster. These had been deposited in damp moss near a small waterfall. All stages were present, the comparatively extremely large egg with white nucleus, the embryo with yolk-sac, the active and fully tailed tadpole, and the matured animal. The fall being nearly perpendicular, no swimming stage was possible; and, in fact, some of the tailed tadpoles were drowned on the way home in the water at the bottom of the receptacle used. . . . The vocal note is a very high-pitched chirp, like that of a cricket" (W. Rose).

Externally, this species differs considerably from *Arthroleptis wahlbergi* (Plate XXXVI, fig. 7). The latter has a very distinct tympanum; males without any indication of external vocal sac; first and second fingers subequal; subarticular tubercles of digits well developed, and the single inner metatarsal tubercle is strong; canthus rostralis fairly well defined; a dark streak from the eye above the tympanum towards the fore-limb, and in front this is continued from the eye to the nostril. On the other hand, *lightfooti* has a very indistinct tympanum; males with slit-like invaginations of unmodified integument on each side of the throat, these slits being not deep; first finger shorter than the second; subarticular tubercles of digits rather weak, inner metatarsal tubercle very small and, in addition, a still smaller outer metatarsal tubercle (not mentioned in the original description); canthus rostralis not defined. The omosternum has its cartilaginous portion nearly as long as the bony portion.

I have no doubt but that *lightfooti* is more nearly related to *Arthroleptis schebeni* Nieden (Sitz. Gesell. Naturforsch. Freunde, Berlin, 1913, No. 10), which is based on four examples from Klein Nauas in the Kalahari, other specimens being recorded from Rehoboth. Dr. F. Werner (in Beitr. zur Kenntnis d. Land- und Süßwasserfauna Deutsch-Südwestafrikas, Reptilia u. Amphibia, Hamburg, 1915) gave other records from the neighbourhood of Windhoek, and added somewhat to the description; but neither of these authors gave any information on the shoulder-girdle characters. In Noble's key to the genus, *schebeni* is placed in the section characterised by the single metatarsal tubercle, no tarsal tubercle, third finger of male greatly elongated; and it is distinguished from all other members of that section from the fact that the tympanum is hidden. However, from the accounts of Nieden and Werner, it seems clear that there are two small metatarsal tubercles. It is chiefly on the indication of the tympanum and the metatarsal tubercles that I place *schebeni* provisionally in the genus *Arthroleptella*.

It is possible that several races of *lightfooti* occur in the Cape Peninsula and neighbourhood. The type specimen, an adult female recorded from Newlands, is somewhat faded, but apparently was only sparingly infuscated when fresh, the lower parts of head and body being quite devoid of dark pigmentation: there is a broad dark stripe from the orbit, passing through the tympanum towards the base of the fore-limb, and in front there is a dark streak from the orbit to the nostril. There are also dark patches and spots on the upper lip,

and on each side of the body dorsally is an irregular row of indistinct ocelli, which are rather distinctive of the species.

Concerning the living colours of some specimens taken at Skeleton Gorge, Mr. Rose wrote as follows: "The dorsal colour ranges from dark oak or russet brown to black, the same individual at times being any of these colours, the change being induced probably by light and emotion. The ventral surface at times is quite white, though many were found with ventral surface almost black, especially on the throat."

Preserved male specimens from Skeleton Gorge all have the throat and breast strongly infuscated, sometimes quite black; the hind half of abdomen is finely speckled black and white, the latter generally predominating; thighs and legs ventrally dark brown with small or minute white spots. The dorsal coloration is very variable; often a reddish tinge is present on the arms and back; there is sometimes a white mid-dorsal line and a series of dark ocelli with white centres on each side of it, several such ocelli being occasionally present on the upper surface of the thighs and tarsi and over the eye. These ocelli may be longitudinally elongated and partially fused into dark dorso-lateral stripes.

The total length is 16 mm.

Preserved specimens from Devil's Peak are appreciably larger, the total length being 20 mm. Also, the adult males are more strongly infuscated, very little white persisting on the abdomen. Young specimens, however, have the whole ventral surface of the body white, with or without a fine black reticulation.

Specimens from Muizenberg Mountain are small, total length 16 mm., and the ventral surface is not so deeply pigmented. An adult female is quite white throughout the ventral surfaces of head and body, but the lower lip is blackish, and the lower surfaces of thighs and legs are white with blackish reticulation, sides of body with blackish reticulation; however, another female has a fine blackish reticulation extending over the white of the lower surface throughout. An adult male has infuscated throat and breast, and the greater part of the abdomen is whitish, but finely marked and speckled with black.

Arthroleptella bicolor sp. nov.

(Plate XXXVI, figs. 9 and 10. Text-fig. 4.)

This new species is based on a series of specimens collected at Wellington, C.P., by K. H. Barnard and R. F. Lawrence in 1922;

types in the collection of the South African Museum. The species is closely related to *lightfooti*, and possibly a range of intermediates between the two will be found. However, it differs from its Cape Peninsula ally in the form of the xiphisternum (see fig. 4), which in *bicolor* is bifid, but in *lightfooti* is more or less anchor-shaped, not divided posteriorly. It is also larger and more robust than *lightfooti* and is differently coloured.

Postero-ventral portion of the thigh with conspicuous scale-like corrugation of the skin extending rather more than half the length of the thigh.

Tongue with deep median incision posteriorly; in *lightfooti* with a broader, more shallow, median incision. Dorsal skin with slight tendency to wartiness, especially over the snout, and also posteriorly; but this is not traceable in some states of preservation. From the angle of the mouth a slight skin fold passes towards base of fore-limb. Interorbital space broader than upper eyelid. Tympanum indistinct. Fingers and toes with slightly swollen tips: toes without web: sub-articular tubercles all small; two metatarsal tubercles, but outer one minute and inner one small: no tubercles on palms or on soles. Adpressed hind-limb with tarsal tubercles reaching to anterior border of eye in females, to the end of the snout or a trifle beyond in males.

Colour of Spirit Specimens.—Upper parts of body and limbs black; female with whole ventral surface of head and body white, one or several white patches on a black background on the thigh, and smaller white markings on the toes, fingers, arm, and fore-arm; male with black throat and white belly, limbs with conspicuous white markings throughout their length, a conspicuous white patch on the chin in one specimen, which in a second example is practically obsolete.

Measurements.—Total length, male 17 mm.; female 21.5 mm.

EXPLANATION OF PLATES.

PLATE XXXV.

FIG.

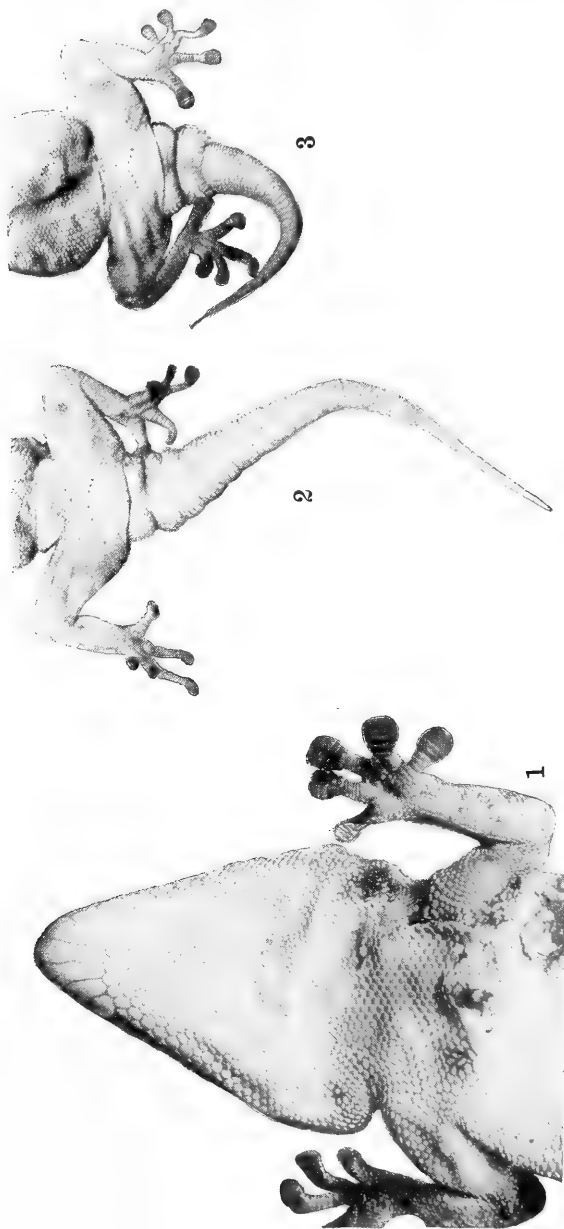
1. *Rhoptropus barnardi* sp. nov. Ventral view, showing characteristic mental and chin-shields, etc., enlarged.
2. *Rhoptropus barnardi* sp. nov. Ventral view of anal region and tail of male.
3. „ „ sp. nov. Ventral view of specimen with reproduced tail.

PLATE XXXVI.

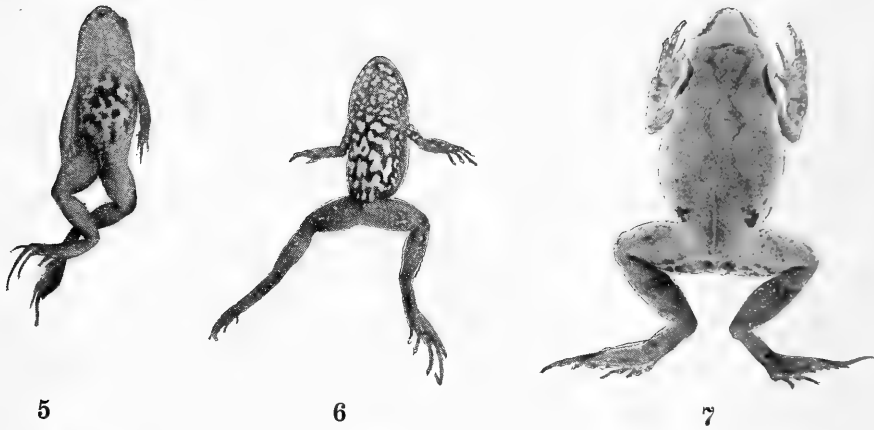
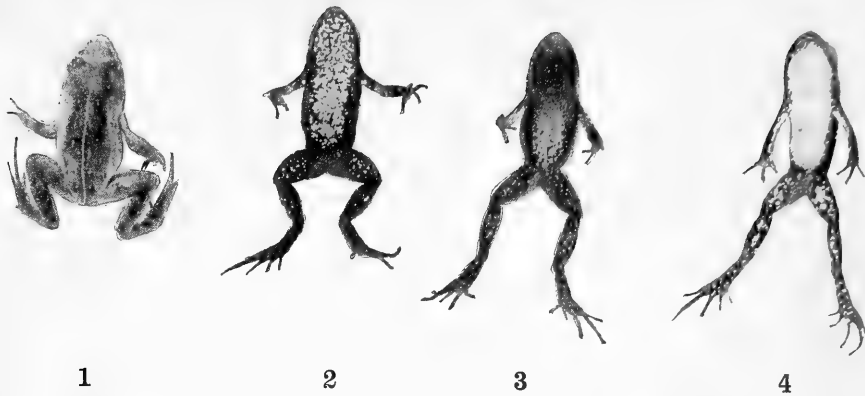
1. *Arthroleptella lightfooti* (Blgr.). Dorsal view of male from Skeleton Gorge, Table Mountain.
- 2 and 4. Females of same species from Muizenberg, ventral view.
3. Male from Muizenberg, ventral view.
- 5 and 6. *Microbatrachus capensis* (Blgr.). Two females in ventral view.
7. *Arthroleptis wahlbergi* (Smith). Dorsal view, specimen from Mariannhill, Natal.
8. *Arthroleptella lightfooti* (Blgr.). Ventral view, male from Skeleton Gorge, Table Mountain.
- 9 and 10. *Arthroleptella bicolor* sp. nov. Female and male, ventral view.

PLATE XXXVII.

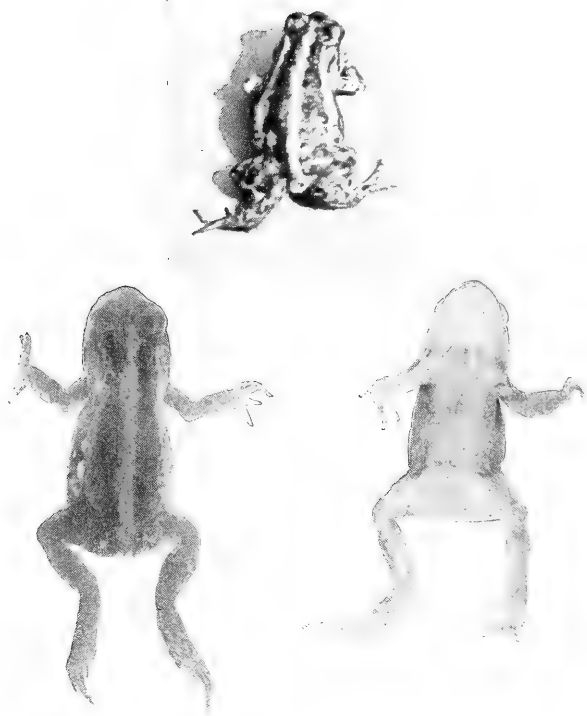
Bufo rosei.



RHOPTROPUS BARNARDI sp. nov.



SOUTH AFRICAN BATRACHIA.



BUFO ROSEI sp. nov.

12. *Some Field Notes on the Batrachia of the Cape Peninsula.*

By WALTER ROSE, L.D.S., R.C.S.Eng.

(With Plate XXXVIII and 8 Text-figures.)

WHEN nearly two years ago I commenced the study of the local Batrachia, I was struck by the paucity of the accessible literature thereon. Since then the field observations, from which the following notes are drawn, have formed a fascinating and healthful week-end hobby, in which the sharp eyes of my sons have materially helped. These notes are now offered, not as an exhaustive treatise, but as a small contribution to South African natural history. The fact that we have been lucky enough to come across several hitherto unrecorded species, and those within fifteen miles of Cape Town, may be taken as an indication of the enormous field for the amateur, as well as for the trained investigator, that lies in the sub-continent. That such a tiny district as the Cape Peninsula should contain almost the same number of species as the whole of Europe is an indication of the immense possibilities of South Africa.

Anatomical data of the species cited are on record elsewhere, and precise details of the tadpoles are outside the scope of this paper, and only details personally observed are included. The term Peninsula, except when used in contradistinction to the Flats, is taken to include the latter up to five miles from the mountains.

Rana grayi, Smith, shows a great variety of colours and markings, and is found everywhere in this district where there is grass, only resorting to water at the mating season. During dry seasons I have found it in earth-cracks two feet down. Voice, a sharp click, in concourse almost deafening. The male is much smaller than the female. Embrace axillary. Eggs deposited in temporary vleis and puddles in May and June: 1200 have been counted. The semilunar embryo is whitish; the tadpole at first is black, later of shades to some extent harmonising with environment. They vary a good deal in the size at which metamorphosis takes place, sometimes reaching 75 mm., at times changing at half that size. Colour changes appear to be

induced by light. A bright brown specimen kept in the dark for a time changed to a light fawn.

Rana fasciata, Boie, frequents long grass by running water, usually on hillsides, but is very numerous in a marsh near the shore at Witsands. Tadpole long and narrow, with yellow vertebral stripe. No voice noticed. Only a moderate swimmer. Has a habit of diving through the long grass rather than jumping over it.

Rana fuscigula, Dum. and Bibr. More aquatic, seldom noted except in pools or streams or on the banks thereof; highly cannibalistic. Voice, a harsh croak. The sticky spawn is found adhering to stones in streams, often in rapid torrents. The tadpoles may remain as such for two or more seasons. The largest I found was 112 mm. long, but metamorphosis may take place at less than half that size. I have often found them in mountain trickles barely deep enough to float them, metamorphosis then being very quick, complete froglets found in September being only 15 mm. from nose to vent.

Pyxicephalus delalandii (Tschudi) is found on sandy soil. Nocturnal, especially during hot weather. Buries itself by kicking backwards into the sand. Male voice a rapid tinkling cluck, "Tuckle-uckle-uckle," the female reply resembling nothing so much as the whine of a door-hinge. Embrace axillary. The small eggs number about 2500. The tadpole is shaped like a conventional heart, the small tail filling the notch. *P. delalandii* is second only to *Breviceps gibbosus* in distensibility. Changes colour similarly to *R. grayi*.

Rappia horstockii, Schleg., is rather plentiful in strictly localised areas: Retreat, Hout Bay, Strandfontein. Generally found in arums or amongst reeds by sluggish rivers; though, as I have found specimens soon after the commencement of the rains, miles of sandy ground from the nearest permanent surface water, and later on by the beds of recently dried pools, I suspect it can aestivate in the damper subsoil.

In my notebook, under 14th December 1924, I find the following: "Four *Rappia*, two on bushes by a sluggish ditch, and two on *Restio* about half a mile distant from the nearest surface water, sand dunes intervening. The day was scorching hot and they were in an entirely exposed position, but were quite moist and cool."

Its favourite site is in the arum bloom, at times two or even three together, the frogs being then an ivory-white colour; hands, feet, and inner parts of thighs bright pink. In other surroundings various shades of brown to mahogany are assumed; the changes, which may occupy a few minutes only, appearing to be a sight reflex. One specimen, when captured, was dark amber with bright green spots and green stripes

above and below the dark lateral stripe. When taken from specimen case it was dark mahogany with light spots, and after some time in the light was very light yellow-brown with no spots. Voice a low croak; chief activity at night. It is very active, leaping upwards of 24 inches and alighting with certainty and precision. A favourite habit is to leap with hind legs wide spread and, when even a single toe touches a reed or the edge of a bloom, to twirl round to the opposite side thereof, out of sight. When perched on even the thinnest grass-stalk, *Rappia* has its feet against and never clutching it. On a flat surface the normal rest position is as shown in the sketch, the hands and feet outlining the stomach and forming a chamber which probably assists adhesion. The male vocal sac is only noticeable at the breeding season, and is protected by a disc of thickened skin, of which, in over 200 living specimens, no suctorial function has been noted. It will be seen that the fingers pass across the vocal sac. The fingers show a vestige of web, the toes being half-webbed. It catches insects with extensile tongue, often leaping a considerable distance and catching them in its mid-flight. These frogs have a habit of sitting on top of one another for hours or even days at a time, sometimes three deep and always exactly dressed and centred. This position, which has nothing whatever to do with mating, is often taken up even when the lower one is in a vertical position, and has only been observed in the case of captive specimens.*



FIG. 1. — *Rappia horstockii*.
Natural size.

I do not consider that either *R. marmorata* or *R. undulata* occur in the Peninsula, and would similarly exclude *Megalixalus spinifrons*.

Cassina senegalensis, Dum. and Bibr., is secretive, inactive, and nocturnal; does not hop, crawls rather slowly, climbs a little, and is only a moderate swimmer, the feet being about $\frac{1}{6}$ webbed. I have obtained most of my specimens by breaking up the decaying roots of *Restio*, so common on the Flats, or by rearing from tadpoles. For such a slow, non-aquatic frog the tadpole is remarkable. It has a long and very broad and powerful tail, the membrane of which extends half-way up the body, dorsally and ventrally, which makes the swimming action very rapid and fish-like. There is a golden or silvery stripe 3 mm. wide along the axis of the tail, on either side. The tadpole grows to a considerable size, and all four limbs and body shape are fully developed before the tail shows the slightest sign of

* See Addendum on spawning, p. 450.

shrinking. When once the shrinkage commences it is very rapid,

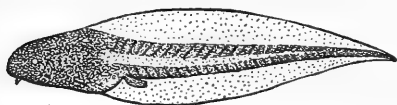


FIG. 2.—Tadpole of *Cassina senegalensis*.
About $\frac{2}{3}$ natural size.

considering the amount of material to be absorbed. A tadpole that had a tail 43 mm. long on 27th December showed only the barest stump on 30th December, the body being per-

ceptibly fatter, though no food was taken in the interval. I have noted the following weights and measurements:—

Measurements—

Length of adult	29 mm.
Tadpole, total length	67 „
„ body length	24 „
„ tail length	43 „
„ depth of tail	15 „

Weights—

Tadpole with four legs and full tail	25 grm.
„ „ „ „ half tail	19 „
„ practically tailless	15 „
Adult	21 „

The specimen described as adult was at least three years old, having been nearly two years in my vivarium, and was the largest of some twenty caught. A dead and dried specimen was found measuring 35 mm. nose to vent. The eggs are probably laid in October, as the first small tadpoles were found in mid-November and metamorphosis is complete about New Year. The vocal sound is a creak like that made by a basket. Embrace axillary. On the throat of the male all the year round is an ovate suction disc 7 mm. by 6 mm. I have noted an application of this when the frog is clinging to the side of a glass vessel, and suggest that it is used when mating, as accessory to the rather weak arms.

Microbatrachus capensis (Blgr.) may be found in small numbers in several places on the Flats, in one locality at least being very plentiful. Generally found round the edges of temporary vleis, but a few have been found in summer in decaying *Restio* roots. Great variety in colour is displayed and considerable individual change. Specimens coloured pale, bright, or dark green, grey, fawn, light or dark brown, russet or black, may all be found in the same pool. Some are uniformly coloured, in others a narrow vertebral stripe is constant; at times broad lateral stripes are seen. I have found a few speckled like

granite, and many have warty backs. Members of a large series may have nothing in common but size and shape. Bright light appears to induce the brighter shades. The belly also shows a great variety of mottling, marbling, blotching, or speckling, and is at times a plain brownish white. The feet show varying degrees of webbing up to $\frac{3}{4}$. Voice, a sharp "tschik, tschik," the male vocal sac being continued over at least half the ventral surface, practically doubling the body size, being comparable in this respect to *Hyla arborea* of Europe. The tiny eggs are deposited in June and July in clusters of about twenty, attached to grasses in shallow pools.

The embryo is semilunar and black. Tadpoles are proportionately large, the converted froglet which I have found on 7th December being little smaller than the adults.

Cacosternum boettgeri (Blgr.). Specimens referable to this species, though, as Mr. Hewitt informs me, not typical *boettgeri*, are only occasionally found on the Flats; generally in close association with *M. capensis*, from which a close scrutiny is required to distinguish them. On the largest specimens I have taken (19 mm. nose to vent, 35 mm. nose to toe) I could detect no trace of web. The stomach is white and is edged with small dark spots. *C. boettgeri* appears smoother and sits flatter than *M. capensis*, and the head is capable of—for a frog—a large extent of lateral movement. Only specimens of brownish colours have been found, the shades of which vary from time to time in the same individual. A broad dorsal stripe with a lighter vertebral streak is usually present. The breeding habits—practically identical with those of *M. capensis*—have been fully described (Hewitt and Power, Trans. Roy. Soc. S. Afr., vol. iii, p. 171).

Cacosternum capense, Hewitt. This species was described from one adult and one juvenile specimen only.* The advent of the rains, 10th June, and with them the breeding season of most of the Peninsula Batrachia, enabled me to secure a number of specimens in the type locality (Rondebosch Golf Links) and to make some notes thereon. On every occasion the numbers of males secured outnumbered the females by at least 6 to 1. The largest female was $38\frac{1}{2}$ mm. from nose to vent, the largest male 32 mm. The male has a very conspicuous vocal sac which is quite black at this season. The voice varies, being at times a metallic "Tock, Tock," at times "Cree, Cree," more like a slate-pencil drawn perpendicularly across a slate. After the mating period little sound was made. The embrace was axillary, the male's nose being pressed hard down on to the female's head.

* Records of the Albany Museum, vol. iii, p. 367.

Nine mating pairs were isolated, the eggs numbering 140, 190, 141, 375, 209, 177, 57, 134, 400. The capsules measured 3 mm. across, and, though separate, were very sticky. The nucleus was white on one hemisphere and black on the other, and 1 mm. across. The embryo is quite white and semilunar. First froglets seen on 7th September. The gait is a series of short hops or rather flops, with now and again a short quick run. Swimming action not very strong, as they only enter the water at the breeding season. They sit very flat. Kept in a vivarium, with shallow water over sand, they lay for hours buried in the sand with the tip of the nose showing sometimes above, but more often below, the surface of the water. This habit, coupled with the fact that during the dry season they remain almost entirely underground, may account for their having escaped discovery until lately (July 1924). In living specimens the dorsal surface is distinctly warty, and in the changing tadpole and froglet these warts are brightly coloured, either green or orange. Above the sacrum appear two small soft tuberosities which, Mr. Hewitt informs me, are skin glands.

Cacosternum capense appears to emit a poisonous secretion, as on one occasion a *Rana grayi* and a dozen *M. capensis*, and on another, 19 out of 25 *Bufo rosei*, placed in the same vivarium, were found dead within a few hours.

Arthroleptella lightfooti, Blgr. Found in several gorges on the Peninsula mountains and, under entirely different circumstances, in a small marsh above St James. Probably at least two types occur. Considerable variety in colour and marked individual change was observed. The voice is a high-pitched chirp like that of a cricket. The largest specimen measured 21 mm. from nose to vent. The breeding habit is of interest. At the beginning of November, in damp moss beside a small waterfall—the favourite habitat—I found several small clusters of eggs, each consisting of five or six closely adherent globules of jelly with large white nuclei. The globules were large—8 mm. diameter—the nucleus being $4\frac{1}{2}$ mm. In some clusters could be seen tailed embryos that wriggled freely in the jelly when it was touched, whilst others showed an intermediate stage. Some were brought home and kept under observation. The embryos, at first white, soon turned darker, except the tail, which remained a translucent white throughout. At the time the hind limbs were appearing, the little larvae left the capsule and wriggled about in the moss. They were quite unable to swim, and died when left in water. Development proceeded very rapidly, the appearance of the fore-limbs and the

absorption of the tail taking place in a matter of hours. The whole time taken for the complete metamorphosis was from a week to ten days. No food was taken and no mouth could be seen, and the complete froglet was little, if any, bigger than the egg nucleus.

Although the little frog only kicked convulsively when placed in water, two left therein completely submerged were alive twelve hours later, the mouth, though then visible, appearing to be sealed up. The next day the froglets were, like the adults, extremely active, and commenced to feed on tiny insects.

Breviceps gibbosus, Linn., is found on the mountains and Flats, generally underground; often under termite or ant-heaps. Burrows by kicking outwards with hind legs and gradually turning round,



FIG. 3.—Stages in the development of *Arthroleptella*. All natural size.

always clockwise. It is generally supposed that members of this genus omit the tadpole stage, and doubtless the breeding habit of *B. gibbosus* resembles that of *B. mossambicus*, of which Mr. G. van Dam of Pretoria has kindly given the following details: "The eggs are large and comparatively few in number. These are deposited by the female in a small chamber, excavated under a stone, not necessarily anywhere near water. The complete metamorphosis takes place within the egg capsule, and the young *Breviceps* eventually emerge completely developed. The female parent remains in the vicinity throughout the period of incubation." I have lately found a specimen, on the Flats, of a *Breviceps* that appears to be well distinct from *gibbosus* in skin-surface, markings, subarticular and metatarsal tubercles, by the mouth being more ventral, by the width of the head being less than 25 per cent. of the body-length compared with 40 per cent. of *gibbosus*, and in being much more active.*

Bufo angusticeps, Smith. Very common in sandy localities from June to New Year, when it disappears. The eggs are deposited in strings during June and July, in puddles and temporary vleis; 650 and 850 have been counted. First complete toadlets, 10 mm. nose to vent,

* This specimen has been sent to Mr. Power, who pronounces it as deserving of specific rank. Descriptions of this and still another new species from Table Mountain are given in his paper on the genus which appears in this volume. The Peninsula will thus contain three species of *Breviceps*.

were seen on 30th August. In one taken on 29th July 1925 the stomach was found to contain 8 univalve molluscs, *Succinea delalandii*, and nothing else, a surprising diet for a toad that only frequents water at breeding season. Embrace axillary. Voice, "Gaa, Gaa, Gaa," slowly. Male throat not darker.

They are moderate swimmers; hop, or run, when alarmed, but the usual gait is a walk. In general appearance, habitat, and habits *B. angusticeps* much resembles *Bufo calamita* of England. Inner side of hind limbs is yellow.

Bufo regularis (Reuss), as found in the Peninsula, is a brilliantly coloured toad of large size. The upper surface is golden brown, olive green, or, occasionally, a vivid wine colour, with a bright yellow reticulation, more or less symmetrical, on either side of a vertebral stripe. The paratoid glands and the skin above the eyes and nose are brick-red. The yellow reticulation and stripe are constant, and though broader in juveniles (which could be described as yellow with patches of the colours mentioned above) are persistent. Specimens collected in the Paarl district differed so much in appearance from the Peninsula type that for some time I regarded them as specifically different. Juveniles dorsally were silvery grey with grey-brown patches. The upper surface of the nose between the eyes, the upper edge and anterior half of the eyelids, the paratoids, and a triangular patch on the back—the size of the nose, and forming therewith, as it were, opposite corners of a square—were brick-red. The adults, whose warts, as compared with the Peninsula type, were large and relatively few, were all a uniform brownish grey, the very slightly darker patches being barely discernible. The largest found was 82 mm. from nose to vent. A pair were taken spawning in the fairly rapid Berg River in January. The strings of spawn were drifting down-stream amongst the stones, no effort being made to entwine them amongst the reeds. Our local *regularis* spawns in August in vleis. The embrace is axillary. Last year I found a pair *flagrante delicto*, and secured the whole family. The male was 98 mm., and the female 137 mm., from nose to vent. The eggs in strings, which were only very slightly involved in the weeds, numbered 24,400, the last section—passed at home—having a club-shaped end. The tadpoles do not grow to any size, and the complete toadlets, found in mid-December, were only 12 mm. long. Some juveniles taken $8\frac{1}{2}$ months later were from 27 mm. in length. Despite the numerous progeny, this toad is comparatively rare compared with *angusticeps*. This is probably due to its longer larval life subjecting it to the attacks of

numerous enemies, notably dragon-fly and other insect larvae; and perhaps in part to the cannibalistic habits of the species, young and old. I have seen a large specimen devour full-sized *R. grayi* and *B. angusticeps*, and its own kind as large as 70 mm. body-length, and on one occasion a 7-inch *Mabuia trivittata*. In taking this larger prey, *regularis* stands right over it and strikes down with open mouth and no noticeable tongue-extension. The male vocal sac distends to the size of a walnut, the voice being a harsh "Waak, waak." The usual gait is a walk or a surprisingly long jump, never a run. A moderate swimmer.

Bufo rosei, Hewitt. I have found these little toads in a small marshy area at an altitude of about 1500 feet above Muizenberg; in close association were found *Rana fuscigula*, *R. grayi*, *R. fasciata*, and a small frog of the *Arthroleptella* genus (gen. nov. Hewitt). The surrounding hillside was bare and rocky, and no toads were found more than a few feet from the marsh.

A fair number of specimens was obtained, chiefly under overhanging grass tufts; in all sizes from 5 mm. to 26 mm., which latter I consider the full adult size. They exhibit all the typical characteristics of toads as to gait, swimming action, and habits; and live well in a small vivarium, feeding freely on flies, which they catch with extensile tongue.

In colour dorsally they are dark grey with three light grey longitudinal stripes, the parotid glands being dark orange. At times the whole dorsal aspect is black, the markings being then either invisible or barely discernible. The belly is greyish white. Compared with most other toads, *B. rosei* has quite a defined neck, and the head is capable of a fair degree of lateral movement.

I have also found this toad in some numbers by small streams at Jackals Drift, a second locality. No spawn definitely attributable thereto has so far been found, though I refer to this species some thick (4 mm.) non-indented ropes of spawn with large nuclei (2 mm. diameter and four to the centimetre) found in the vicinity. I suggest that careful search of the mountains of the mainland will prove that this little toad has a fairly wide range at altitudes above 1000 feet.

Heleophryne rosei (Hewitt) was fully described by Mr. Hewitt.* In all, we have caught 6 adults and 15 juveniles in Skeleton Gorge on Table Mountain. All were found under stones in or beside the rushing stream. Tadpoles, which are distinguished by a remarkable suction disc around the mouth, were plentiful under rocks, to which they

* Records of the Albany Museum, vol. iii, p. 363.

closely adhered; and a number were induced to complete their metamorphosis in an irrigated aquarium. It is certain that they may, and probably always do, pass at least two seasons as tadpoles. They are never observed swimming unless disturbed, when a quick dart is made to another anchorage. In the aquarium the suction disc could be well observed through the glass, the tadpole moving forwards from time to time as it devoured the algae. The colour dorsally is dark green. The skin on the ventral surface is so thin that the gills and viscera show clearly, red and black respectively. The spiracle is sinistral and very conspicuous. The maximum length is 47 mm., of which the head is 10 mm. and the body $9\frac{1}{2}$ mm., the head being $9\frac{1}{2}$ mm. wide. Tadpoles taken on the opposite side of Table Mountain and referred to this species were of a light amber

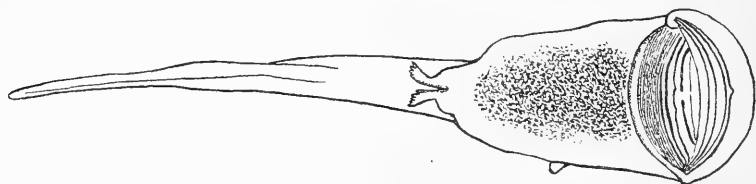


FIG. 4.—*Heleophryne rosei* tadpole.

colour, very young ones being transparent. Large yellow eggs dissected from a female resembled those obtained similarly from a *Breviceps*, and though I have never actually found eggs, I suspect that they are deposited in a hole in the river bank and—judging by the date the tiny tadpoles were found—early in June. The adults, of which the largest males and females were 41 mm. and 63 mm. respectively, are nocturnal, and I consider decidedly aquatic. They remained for hours submerged in the tank of a vivarium, taking no interest in an aloe—despiked—growing beside it; though later they hid in hollows at the roots. I have noticed that, when sloughing, the skin is allowed to float away piecemeal, the frog making no effort to hasten the process. When under water the eye is covered by a thin transparent membrane. The iris is green, the pupil diamond-shaped. On one occasion a *H. rosei* was heard to give a chirp, but no other vocal sound has been heard. I could not induce them to eat insects, and suspect that their food is aquatic crustacea and larvae. Some *H. purcelli*, captured in a similar locale near Groot Drakenstein and kept in the same vivarium, though remaining under stones in the tank for three days after capture, later on were often found perched on a horizontal branch. They jumped readily at flies, and are perhaps

more arboreal than *rosei*, as the thicker-skinned granular belly suggests; but they certainly did not display anything of that grace and agility in leaping and climbing which is seen to such advantage in the European tree-frogs and our local *Rappia*. The dorsal colours of *rosei* are dark green reticulated with dark brick-red, the ventral surface whitish, the abdominal viscera showing through the smooth skin. In *purcelli* the dark green is more extensive, the reddish markings appearing only as spots. *Purcelli* tadpoles are light amber spotted with black, stomachs quite white.

Xenopus laevis (Daud.). A good deal has been written about this frog and its tadpole, but most accounts appear to emphasise its essentially aquatic habits and predilection for deep rivers, ponds, and

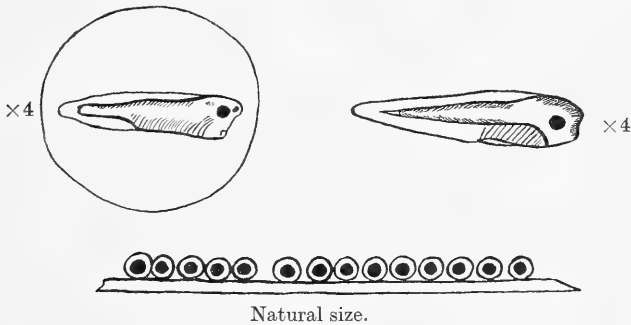


FIG. 5.—Eggs and tadpoles of *Xenopus laevis*.

dams. Large stretches of the Cape Flats consist of rolling sand dunes, the hollows between which—for half the year dry sand—the June rains convert into small pools a few inches deep. It is hardly conceivable that any Plathander, even if it so desired, could reach these pools from permanent water which may be several sandy miles away, yet in mid-July well-grown tadpoles can be found. Also I have found hundreds of juveniles huddled together in the last remains of a nearly dried vlei, so close that scores were caught by pulling a small bag through the water. The situation was such as to make migration out of the question. My notes state: "April 6th, about 200 Plathanders caught in a pool about 6 square feet in size, as many more being left." This year, just before the rains, I dug up a *Xenopus* from the same locality. Apropos of this specimen, I suggest with all reserve the possibility of there being another species of *Xenopus* on the Flats. This specimen—and a dozen others found since—in my opinion differed from the normal on the following points: Nose

sharper, teeth much longer, hind limbs proportionately longer, feet not quite so fully webbed, eyes smaller, and tentacles not apparent, having in the mouth a peculiar organ that could most appropriately be described as having the appearance of a posteriorly attached tongue or a deflated air-sac. The stomach was brownish. Length, nose to vent 56 mm., nose to toe 120 mm.

The eggs, which continue to be deposited until August, are 3 mm. across. Nucleus 2 mm. They are attached in single file, touching, along one side of stalks of grass or water-weed. The tadpole is complete in a week and for another week remains absolutely motionless, head upwards, at or near the surface. Later they are always seen

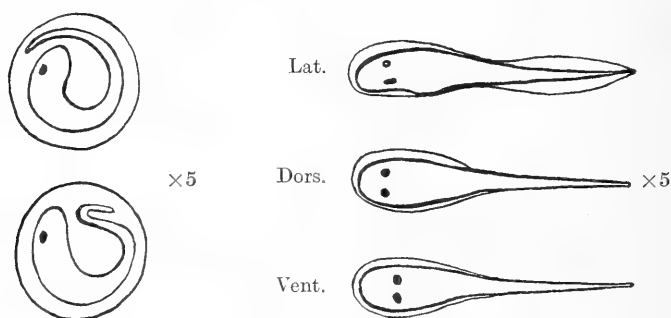


FIG. 6.—Tadpoles described on p. 445.

vertically, head downwards, maintaining position by movement of the very tip of the tail, the wide soft mouth apparently sucking in minute animalcules. The first complete froglets were found on 28th October, but in deeper water the tadpoles may be found till much later.

The Plathander has a peculiar habit of forking its food into its tongueless mouth with its long fingers, at times actually grasping the prey therewith before seizing it with the mouth. The diet is worms, insects, small frogs, tadpoles, and small fish. When under water the eye is often covered from below by a transparent nictitating membrane. By keeping *Xenopus* in glass jars surrounded by black and by white paper I have induced marked corresponding colour changes. It is, I think, known that the Plathander can survive in brackish water. A half-grown specimen was placed in 62½ ounces of water and 60 grains of sodium chloride was added each day. It was not until 360 grains had been added that the frog showed signs of discomfort, the altered density of the water preventing it from leaving the surface except by an effort. No more salt was added, but death

ensued four days later. The body had a stiff leathery feel and the skin was quite devoid of slime. I have frequently found *Xenopus* in close association with *M. capensis*, which is surprising in view of the former's habits. In or by one small sand-dune vlei, a few inches deep, on one day lately I found *Xenopus*, *R. grayi*, *R. fuscigula*, *B. regularis*, *B. angusticeps*, *R. horstockii*, *C. boettgeri*, *M. capensis*, *P. delalandii*, and a *Breviceps*.

Recently (21st June 1925) I found near Jackals Drift several clusters of frogs' eggs of a type that I cannot refer to any known species, except by presumption of an aberrant habit. These eggs, which were not in any degree adherent, were deposited to the number of 100 or so in small cup-shaped depressions in grass tufts or between them, which had the appearance of having been formed by the parents. A hundred or more eggs—diameter 3–4 mm., nucleus 2 mm.—were in each cluster, in some cases 50 per cent. being unfertile and of a milky opacity. A very transient puddle containing some toad spawn was near at hand. Most of the eggs in these clusters, which could never have been in water, contained a fully developed tadpole which wriggled slightly within a transparent capsule, which offered considerable resistance to pressure, and reminded one of a fortune-teller's crystal. Some were placed in water and some kept on damp earth. In both cases a tadpole—7 mm., of which the tail was 4 mm.—emerged in a few days, swimming strongly or wriggling in the mud, leaving a distinct empty envelope. After a few days, owing to the difficulty of keeping the mud in the vessel uniformly moist, I transferred all to water. In the capsule, and for some days later, no mouth could be discovered with a $\times 20$ lens, though two small circular spots, on the ventral aspect, that I took to be gill orifices, could be seen. The iris was golden and the pupil round. Surrounding the whole body, a transparent envelope could be detected.

In a few days more the usual tadpole mouth appeared, and up to the present the tadpoles are not very distinctive. Identification must await complete metamorphosis;* but I may mention that as the result of a thorough search, including digging, only *Rana grayi* were found, but no normal spawn nor tadpoles thereof, though in other localities every puddle swarmed with the latter.

* Since the above was written a number of tadpoles have completed their metamorphosis, but no difference can be detected between them and normal *R. grayi*; the conclusion being that certain of this species have developed an egregious metamorphosis. The only vlei in the vicinity, though some miles from the sea, was strongly saline.

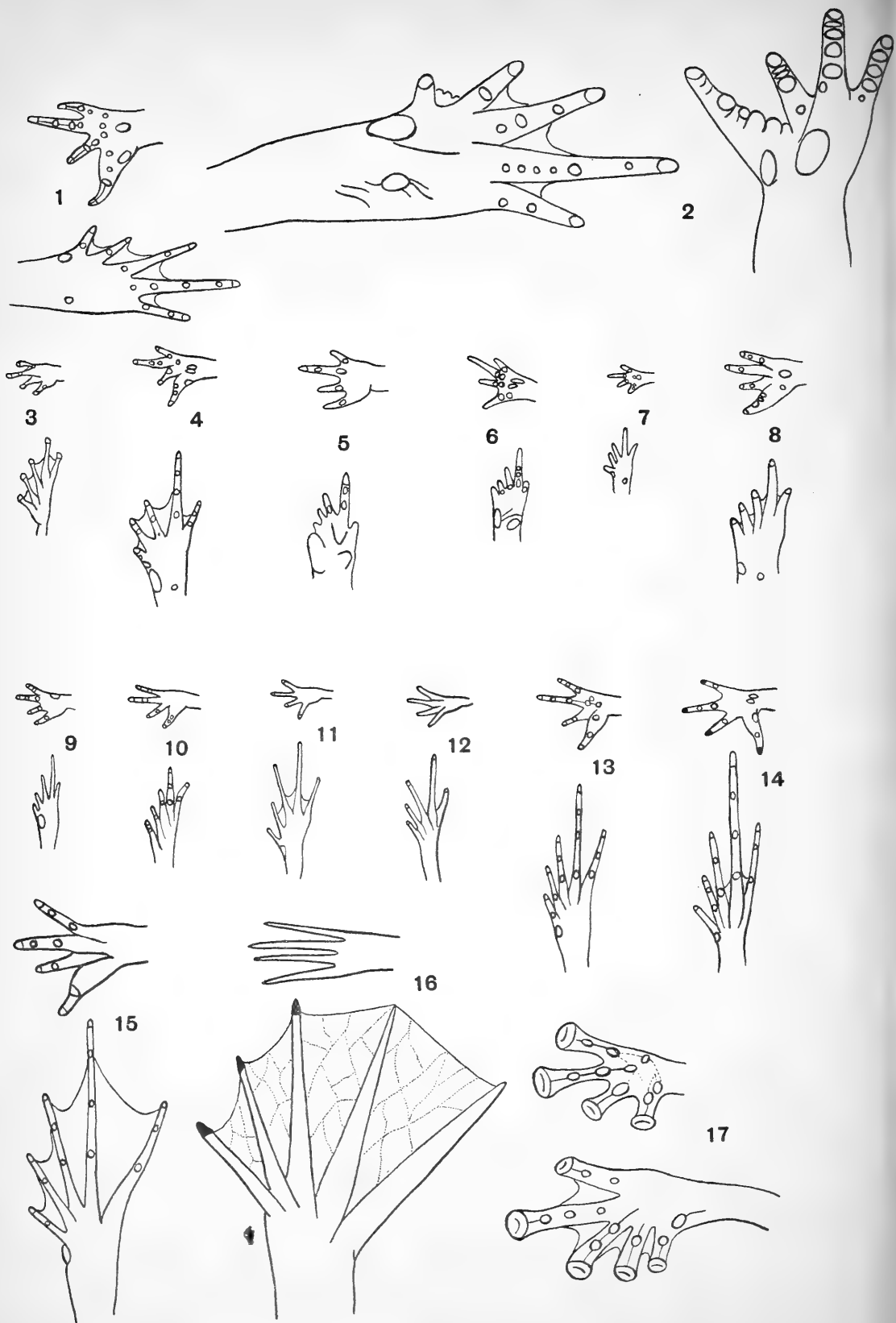


FIG. 7.

EXPLANATION OF TEXT-FIGURE 7.

Under-surface of left hands and feet of Peninsula Batrachia. All of the natural size except two.

- | | |
|---|---|
| 1. <i>Bufo regularis</i> , mainland type. | 10. <i>Cassina senegalensis</i> . |
| 2. " " Peninsula type. | 11. <i>Microbatrachus capensis</i> . × 2.* |
| 3. <i>Rappia horstockii</i> . | 12. <i>Arthroleptella lightfooti</i> . × 2. |
| 4. <i>Pyxicephalus delalandii</i> . | 13. <i>Rana grayi</i> . |
| 5. <i>Breviceps gibbosus</i> . | 14. " <i>fasciata</i> . |
| 6. " sp. | 15. " <i>fuscigula</i> . |
| 7. <i>Bufo rosei</i> . | 16. <i>Xenopus laevis</i> . |
| 8. " <i>angusticeps</i> . | 17. <i>Heleophryne rosei</i> . |
| 9. <i>Cacosternum capense</i> . | |

To summarise : the local Batrachia that resort to water for breeding only are *Rana grayi*, *Cassina senegalensis*, *Pyxicephalus delalandii*, *Cacosternum capense*, *Bufo regularis*, *Rappia horstockii*, and, remaining in water somewhat longer, *Microbatrachus capensis* and *Cacosternum boettgeri*. Except *R. grayi*, the above practically disappear during dry months. Found by permanent streams are *Rana fasciata*, *Bufo rosei*, *Rana fuscigula*, *Arthroleptella lightfooti*, and *Heleophryne rosei*, the last being confined to mountain gorges. *Xenopus* frequents sluggish rivers and vleis, both temporary and permanent.

In *Pyxicephalus delalandii*, *Cacosternum capense*, *Cassina senegalensis*, *Arthroleptella lightfooti*, and *Microbatrachus capensis* the male throat is very dark, especially during breeding season. In *Rana grayi*, *Rappia horstockii*, *Bufo regularis*, and *R. fuscigula* less but noticeably so ; in the others I have not observed any difference.

Individual colour changes are very marked in *Microbatrachus capensis*, *Xenopus laevis*, *Arthroleptella lightfooti*, *Rappia horstockii*, *Pyxicephalus delalandii*, *Cassina senegalensis*; somewhat less so in *Bufo angusticeps*, *Bufo rosei*, *Rana fuscigula*, and *Rana grayi*; and little or none noted in *Bufo regularis*, *Breviceps gibbosus*, or *Heleophryne rosei*.

I have found free-swimming tadpoles of all except *Arthroleptella lightfooti*, *Breviceps gibbosus*, *Rappia horstockii*,† and, to be positive, *Bufo rosei*; and spawn of all except the last three and *Rana fasciata*, *Heleophryne*, and *Cassina senegalensis*. I do not think, however, that any but the first two, and probably *Heleophryne rosei*, depart from the usual habit.

The local distribution, based on a very thorough search and in most cases many scores of captures, may be given as follows :—

Flats and low-lying parts of the Peninsula only : *Xenopus laevis*,

* Feet of *Cacosternum boettgeri* practically identical but lack the web.

† See Addendum, p. 450.

Cassina senegalensis, *Rappia horstockii*, *Microbatrachus capensis*, *Cacosternum boettgeri*, *Cacosternum capense*, *Pyxicephalus delalandii*, and *Bufo angusticeps*.

On high ground only: *Bufo rosei*, *Arthroleptella lightfooti*, and *Heleophryne rosei*.

On both: *Bufo regularis* (one only from the mountain), the three *Ranae*, and *Breviceps gibbosus*.

Markedly cannibalistic are *Bufo regularis*, *Xenopus laevis*, and *Rana fuscigula*; the others seldom depart from the usual Batrachian diet of insects.

There is no Peninsula species the spawn of which floats in water like that of *Rana temporaria* of Europe.

I think only approximate times can be assigned to the various stages of the free-swimming tadpoles, and only minimum times are worth recording, food-supply, light, depth, and temperature of the water being determinative factors; but, as would be expected, species such as *Rana grayi*, *Pyxicephalus delalandii*, *Bufo angusticeps*, and *Cacosternum capense*, which spawn in the nearest puddle, have the shortest larval life (except *Arthroleptella lightfooti*). *Bufo regularis*, *Microbatrachus capensis*, and *Cassina senegalensis*, which choose the larger temporary vleis, come next, and so on. I believe that, under a certain maintained condition of the above factors, the tadpoles of many species could be kept almost indefinitely as such. Observers up-country should bear in mind the reversal of the rainy seasons, our rains commencing in June.

A point that I have noted as persisting in a large number of widely separated South African species is a dark mark shaped like a boomerang on the head, concavity forwards, and ends extending over the eyes, and sometimes divided in the centre. Its significance may or may not be protective concealment, but its frequent occurrence is remarkable.

On the opposite page are drawings of the left eyes of the Peninsula Batrachia, made from living specimens. The eyes of preserved specimens often show an unnatural shape, as was brought to my notice in the case of *Bufo angusticeps* by Mr. Hewitt. All the drawings were made under the same light conditions, but it should be remembered that the irides of the more nocturnal species may show a disproportionate contraction.

Sizes of the various species in millimetres, mostly maximum (nose to vent and nose to toe respectively), are as follows: *Rana grayi* 42 and 115; *R. fasciata* 47 and 142; *R. fuscigula* 95 and 245; *Py. delalandii*

48 and 113; *Rappia horstockii* 35 and 84; *Cassina senegalensis* 29 and 67; *Arthroleptella lightfooti* 20 and 41; *Microbatrachus capensis* 20 and 37; *Cacosternum capense* 38 and 75; *C. boettgeri* 19 and 35; *Breviceps gibbosus* 48 and 65; *Breviceps* sp. 38 and 68; *Heleophryne*

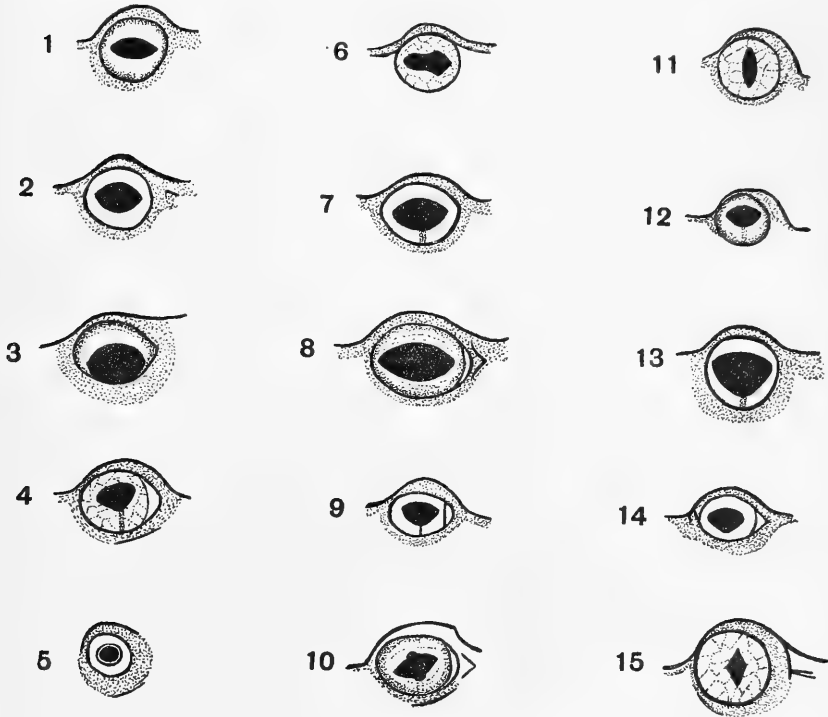


FIG. 8.—Left eyes of Peninsula Batrachia.

- | | |
|--|--|
| 1. <i>Cacosternum capense</i> . ×2. | 9. <i>Rana grayi</i> . ×2. |
| 2. <i>Bufo rosei</i> . ×3. | 10. <i>Bufo angusticeps</i> . ×2. |
| 3. <i>Breviceps</i> sp. ×2. | 11. <i>Cassina senegalensis</i> . ×2. |
| 4. <i>Pyricephalus delalandii</i> . ×2. | 12. <i>Rana fuscigula</i> . Natural size. |
| 5. <i>Xenopus laevis</i> . Natural size. | 13. <i>Arthroleptella lightfooti</i> . ×5. |
| 6. <i>Rappia horstockii</i> . ×3. | 14. <i>Rana fasciata</i> . ×2. |
| 7. <i>Microbatrachus capensis</i> . ×5. | 15. <i>Heleophryne rosei</i> . ×2. |
| 8. <i>Bufo regularis</i> . Natural size. | |

rosei 60 and 165; *Bufo angusticeps* 68 and 110; *B. regularis* 137 and 260; *B. rosei* 26 and 50; *Xenopus laevis* 105 and 198.

In conclusion, I wish to record my great appreciation of the helpful advice and encouragement given to me by Dr. K. H. Barnard, Mr. J. Hewitt, and Mr. J. H. Power, without which these few notes could never have been attempted.

EXPLANATION OF PLATE XXXVIII.

Left above : *Cacosternum capense* (male above).

Left below : *Bufo regularis* (Paarl type). $\times \frac{5}{7}$.

Right above : *Bufo regularis* (Peninsula type), young.

Right below : *Bufo regularis* (Peninsula type). $\times \frac{2}{3}$.

ADDENDUM to p. 447 : spawning of *Rappia horstockii*.

Early in November, captive specimens deposited spawn in clusters of from 10 to 30 eggs attached to the roots of water-weeds (Canadian Water Hyacinth). The jelly capsule was 4 mm. in diameter, and the nucleus, which was white on one hemisphere and russet-brown on the other, was 2 mm. across. The tadpoles, which were not successfully reared, were translucent, with a decided brown pigmentation.



CORRIGENDA AND ADDENDA.

Rappia horstockii, p. 434, near foot, should read "appearing to be a skin, rather than a sight, reflex."

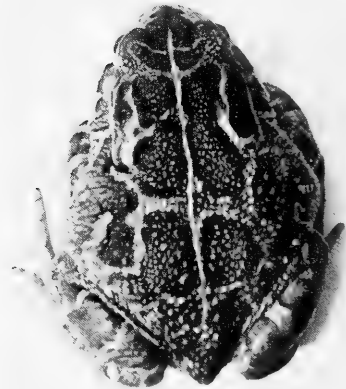
Cassina senegalensis, p. 435. Mr. Hewitt considers the Peninsula type to be deserving of a distinctive name, and has suggested *Cassina weali quinquevittata*.

Microbatrachus capensis, p. 436. The name *Microbatrachus* proving to be preoccupied, Mr. Hewitt has changed this to *Microbatrachella*.

Distinctive *Xenopus*, pp. 443-4. This has now been described as *Xenopus gilli* in paper read to Royal Society of South Africa in August, 1926. (Hewitt & Rose.)

Xenopus in saline, pp. 444-5. This is not a personal note; but I have not been able to trace the reference.

Rana grayi, pp. 433 and 445. I find that I have been guilty of an error regarding the breeding habit of this. When making notes thereon, I accepted too readily the current idea; and attributed to *R. grayi* clusters of the spawn of *Cacosternum capense*, this species being then unknown. I have since found out that the habit described on p. 445 and figured on p. 444, as possibly egregious, is the normal habit of *R. grayi*; though elsewhere the eggs were found scattered promiscuously. This rather unusual habit would seem to have its explanation in the extremely variable and precarious nature of the early rain-pools so favoured by this frog. The deletion of the words "The semilunar embryo is whitish" on p. 433, will leave the account of *R. grayi* correct, with that on p. 445 as amplification.



SOUTH AFRICAN BATRACHIA.

Photos: WALTER ROSE.

Neill & Co., Ltd.

13. *A Monographic Revision of the Genus Breviceps, with Distribution Records and Descriptions of New Species.*—By J. H. POWER, F.Z.S.

(With Plates XXXIX–XLIII.)

IN working through certain of the frogs and toads some time ago, I was surprised at the very unsatisfactory state of the synonymy of this genus.

It may be well at the outset to give a résumé of the history of the genus.

The attention of scientists was first drawn to this peculiarly South African toad by Linné in 1758,* when he described a specimen from the Cape under the name of *Rana gibbosa*. Sixty-two years later, in 1820, the genus *Breviceps* was made by Merrem † with Linné's species as the type.

Next *B. verrucosus* was described by Rapp,‡ in 1842, from material collected in Natal.

In 1855, Peters described § *B. mossambicus* from a collection made on the island of Mozambique and at Sena. The same author in 1882 || referred to another form in a more or less passing sort of way. He says: "Another not yet described variety is *B. adspersus*, Peters, which I obtained between the 25° and 26° Lat. S., from the Transvaal as well as from Damaraland, S.W. Africa. On the back, but especially on the sides, of the body are scattered granules, whereas the belly is smooth."

Werner described ¶ another new form, from "perhaps Grahams-town," under the name *B. pentheri*, in 1899.

B. macrops was described from Namaqualand by Boulenger ** in 1907, and quite recently (January 1925) Hewitt †† has described three new species under the names *B. fuscus*, *B. tympanifer*, and *B. parvus*.

* Systema Naturae (10th edition), vol. i, p. 211.

† Trent. Syst. Amph., p. 177.

‡ Arch. Naturg., vol. viii, pt. i, p. 291.

§ *Ibid.*, vol. xxi, pt. i, p. 58.

|| Reise nach. Mossamb., vol. iii, p. 177.

¶ Zool. Anz., No. 581, p. 116.

** Ann. Mag. Nat. Hist., (7), vol. xx, p. 46.

†† Ann. Natal Mus., vol. v, pt. 2, p. 189.

Later still, in a paper read before the Zoological Society of London, on 21st April 1925, Mr. Loveridge describes another new species which he calls *Breviceps uluguruensis*.

From the description and figure given of this specimen, taken in the Uluguru Mountains, Tanganyika Territory, it is clearly not a member of the genus *Breviceps*.

As already stated, Werner described *B. pentheri*, in 1899, from what was evidently an immature specimen (15 mm. long), but afterwards reduced it to a synonym of *B. verrucosus*; while Boulenger,* in 1910, put both as synonyms of *B. gibbosus*, so that in his revised list † he recognises only four species, *B. gibbosus*, *B. adpersus*, *B. mossambicus*, and *B. macrops*. There is no doubt that the species named *adpersus* by Peters, and that so named by Boulenger, are quite different forms. So obvious a distinction as the larger eye-opening, by which Boulenger separates it from *gibbosus*, would certainly have been noticed and mentioned by Peters. Most probably Peters' *adpersus* is the same as the specimens in the Transvaal Museum from Kastrol Nek, which I refer to Hewitt's recently described *parvus*, though Hewitt considers the Grahamstown examples of the species as possibly the same as *B. pentheri*.

Again, Hewitt says ‡: "It seems very probable that *pentheri*, Wern., and *adpersus*, Pet., are the same, and I cannot separate them from *mossambicus*, Pet.

"The Kimberley species, which I provisionally referred to *pentheri*, is presumably the same as *adpersus*, Pet."

The form occurring at Kimberley is now definitely known to be *mossambicus*.

As regards *verrucosus*, Rapp, Hewitt says §: "Recently I have compared Rapp's description with material in the British Museum collection, and though unable to identify it with any known species, am content to believe that *verrucosus* is really based on material from Natal (coll. Krauss), as stated in his description, the illustration apparently representing a species in which the fourth finger is much shorter than the second; in any case, Rapp's figure is unlike the Knysna specimens in pigmentation and in the nature of granulation."

At one time Boulenger put specimens from Knysna under *verrucosus*, but, as stated above, afterwards put the species as a synonym of

* Ann. S. Afr. Mus., vol. v, pt. 9, p. 534.

† Boulenger, *loc. cit.*

‡ Ann. Trans. Mus., vol. iii, No. 1, p. 54.

§ Ann. Natal Mus., vol. v, pt. 2, p. 192.

gibbosus. Hewitt * has now described the Knysna form under the name *B. fuscus*, and in the concluding sentence of his description of *B. tympanifer*, he says: "This species I might perhaps have referred to *verrucosus*, Rapp, but for the fact that the description thereof includes 'Das Trommelfell verdeckt.'"

Such then, in brief, is the history of the systematics of the genus. In the present paper four new species are being added.

Thanks to the directors of the various museums, the author has been able to examine a large series of specimens from all parts of the Union, Rhodesia, and Portuguese East Africa.

The relative lengths of the second and fourth fingers were taken as a primary means of separating the various species, but as the work of examination proceeded, it was found that many specimens grouped according to this definition with *B. gibbosus* were in other respects near *mossambicus*.

Each of the diagnostic characters given in Boulenger's revised list was then taken separately, tested through a large series of specimens, and the results tabulated. These showed such variation, and in many cases overlapping, that it became evident that averages only could show the true state of things. The averages, therefore, in addition to the ranges of variation, are given on page 459.

Other characters described hereafter were then explored as possible means of separating the different forms.

SNOUT INTO BODY.

When typical specimens of each of the existing species were put side by side, the difference in the appearance of the snout was so striking that it was examined as a possible source of diagnosis (see Plate XXXIX, figs. 1, 4, and 8). The proportions between the lengths of snout and body of ten specimens of *B. gibbosus* (Cape), twelve of *B. mossambicus* (various localities), four of *B. macrops* (Namaqualand), were taken with the following remarkable results:—

Length of Snout † into Length of Body.‡				
<i>B. gibbosus</i>	.	.	.	8 to 8 $\frac{5}{7}$ times.
<i>B. mossambicus</i>	.	.	.	4 $\frac{2}{3}$ „, 5 $\frac{2}{3}$ „
<i>B. macrops</i>	.	.	.	3 $\frac{3}{8}$ „, 4 $\frac{1}{3}$ „

* Hewitt, *loc. cit.*, p. 191.

† Measured from a line joining the posterior corners of the eye-openings to the tip of the snout between the nostrils.

‡ Measured from snout to vent.

It was now clear that this was an important character apparently overlooked by previous authors. The work of testing it through a large series of specimens was then undertaken. The results will be found in the table on page 459. (See also Plate XXXIX, figs. 1 to 10.)

BODY.

In two specimens from Table Mountain, and one from Hottentot's Holland, Caledon Div., the body is extremely rough throughout, even to the upper surface of the hands, arms, legs, and feet. In the Hottentot's Holland specimen the dorsal tubercles are comparatively large and crater-like, and in the Table Mountain specimen they are small and granular.

Specimens from St. John's, Transkei, have the body thickly covered throughout with small flat, pitted tubercles. In those from Knysna the body is very rough, especially the dorsal surface, and all round the head. There may be no distinct tubercles, but pits or ruts going in all directions, or there may be raised, warty tubercles scattered rather sparsely over the dorsal surface. Under the head they are very rough, but not so rough on the abdomen; the ventral tubercles may be rather small and flattened, or they may be quite smooth on the abdomen. Sometimes the posterior third of the dorsal surface, the sides, and the whole ventral surface except the chin are smooth.

Those from the Cape Peninsula, the home of typical *gibbosus*, are very rough throughout, covered with large flat tubercles or small pitted ones, which give them a crater-like appearance; occasionally the posterior quarter of the dorsal surface, the sides, and the whole ventral surface are quite smooth.

Certain specimens from Mariannhill and Umbilo, Natal, have the body above, together with the arms and legs, covered with small prominent tubercles. Ventrally, the centre of the abdomen is fairly smooth, the remainder having flattened tubercles, save under the head, which is covered with small tubercles as dorsally.

Typical specimens of *macrops* from Namaqualand are perfectly smooth throughout; the head, legs, feet, arms, and hands have a high polish. A very occasional specimen may be slightly rough above, through numerous tiny skin folds.

Of two specimens from Port Nolloth, one has the latter third dorsally, the sides, under the head, and the abdomen, finely granular. The other is perfectly smooth throughout, except under the head, where the skin is wrinkled, giving it a rough appearance. The upper surface is highly polished.

Specimens from various localities in the Cape Province, Natal, Transvaal, Rhodesia, and Portuguese East Africa I have placed as *B. mossambicus*; they show the following variations: Above, rough, with large flattened or small raised tubercles pitted all over with pores; below, smooth or slightly granular; or smooth throughout; or posterior half of body covered with flat tubercles; or with soft folds of the skin giving them a warty-looking appearance; or granular on the sides only.

A large series from Kastrol Nek, and specimens from Bindura, Barberton, Lourenço Marques, Masiene, and Komatipoort, were quite smooth above, pitted or with large flat tubercles; the skin at the sides slightly granular or folded irregularly, transverse folds in the region of the abdomen; below, smooth or slightly granular on the chin.

CHARACTER OF TUBERCLES UNDER FINGERS AND TOES.

In typical specimens of *B. gibbosus* (Plate XL, fig. *b*, 1 and 2) from the Cape Peninsula there is a large flat tubercle at the origin of each finger and toe, also under the middle joint of the longest finger and toe, but rather indistinct on the toes; sometimes the fingers and toes granulated or having a corrugated appearance. The palms of the hands and soles of the feet usually have the skin folded, giving them a wrinkled appearance, but they may have faint tubercles, or they may be smooth.

In specimens from Table Mountain (Plate XL, fig. *c*, 1 and 2), and one individual from Hottentot's Holland, Caledon Div., the palms of the hands and soles of the feet are extremely rough and granular, being thickly studded with prominent, small, rounded, or sub-conical rather hard tubercles. Specimens from St. John's (Plate XL, fig. *h*, 1 and 2), Transkei; Umbilo, Natal; and one from Mariannhill, have a large, flat, oval or round tubercle at the origin of each finger and toe, smaller ones on the palms of the hands; the soles of the feet studded with a mixture of small and large irregular ones. The individuals which occur at Knysna and George (Plate XL, fig. *d*, 1 and 2) may have a large flat tubercle at the beginning of each finger and toe, rather indistinct on the toes; or fingers and toes corrugated inferiorly, or a double sub-conical tubercle at the origin of each finger and toe and at the middle joint of the longest. The skin in folds on the palms of the hands and soles of the feet gives them a rugged appearance.

Specimens from Kastrol Nek (Plate XL, fig. *a*, 1 and 2), Barberton, Louw's Creek, Komatipoort, Lourenço Marques, Masiene, Inseleni,

have a large subconical tubercle at the origin of each finger and toe, also large rounded ones on the palms of the hands; or the whole surface of the hands finely granular; soles of the feet smooth. In the case of two specimens from Port Nolloth (Plate XL, fig. *g*, 1 and 2) the hands and feet are much the same, as regards roughness, as in those from Kastrol Nek, except that the tubercles are much smaller. As a rule the feet and hands in *B. macrops* (Plate XL, fig. *e*, 1 and 2) are perfectly smooth throughout; very occasionally a few indistinct tubercles may be found under both hands and feet.

It may be mentioned here that the fingers and toes of this species are very short and stumpy, the first, second, and fifth toes often being mere buds.

In *B. mossambicus* (Plate XL, fig. *f*, 1 and 2) there is a large chisel-shaped, rounded or flat tubercle under each joint of the fingers and the longest toe, also on the palms of the hands; soles of the feet smooth, or with a large flat tubercle at the base of each toe; sometimes palms of hands, fingers, and toes finely granular, or palms of hands smooth.

From the foregoing it will be seen that the genus reaches its maximum of roughness in *B. montanus*, giving a complete range of degrees through *gibbosus*, *fuscus*, *tympander*, *namaquensis*, *mossambicus* to *macrops*, which is more or less smooth throughout.

INNER AND OUTER METATARSAL TUBERCLES.

The differences in these characters among the typical forms are worthy of note. They consist of: the size and shape of the tubercles, the relationship between the base of the inner metatarsal tubercle and the axis of the longest toe, and whether or not it extends beyond the side of the foot.

In typical *mossambicus* (Plate XL, fig. *f*, 2) the inner metatarsal is large, with a rather blunt, or sometimes sharp, digging edge; not extending beyond the side of the foot; at right angles to the sole of the foot or directed inwards towards it. Base at from 40° to 45° to axis of longest toe. Outer metatarsal small, distinct from the inner, or hardly so.

The Kastrol Nek specimens (Plate XL, fig. *a*, 2) have a comparatively large inner metatarsal tubercle with a sharp digging edge at right angles to the sole of the foot, or directed inwards towards it; not reaching beyond the side of the foot; base at from 30° to 45° to axis of longest toe. Outer metatarsal small, scarcely distinct from the inner.

In typical *gibbosus* from the Cape (Plate XL, fig. *b*, 2) the inner metatarsal tubercle is large and thick, very blunt, practically no digging edge; projecting beyond the side of the foot; axis of base at from 50° to 60° to axis of longest toe. Outer metatarsal large and scarcely distinct from the inner.

In Knysna and George specimens the inner metatarsal tubercle is rounded and pebble-like; scarcely any digging edge; projecting beyond the side of the foot; axis of base at 60° to axis of longest toe. Outer metatarsal about half as large, united to or distinct from the inner.

Three specimens from Table Mountain (Plate XL, fig. *c*, 2) have a comparatively large, oval, pebble-like inner metatarsal; not projecting beyond the side of the foot; surface rounded, no digging edge; base at 30° to 40° to axis of longest toe. Outer metatarsal quite distinct from the inner; prominent.

In *B. macrops* (Plate XL, fig. *e*, 2) the inner metatarsal is long and narrow, rather indistinct, sharp cutting edge; not projecting beyond the side of the foot; axis of base 30° to axis of longest toe, or parallel thereto. Outer metatarsal absent, or very indistinct.

In the case of two specimens from Port Nolloth (Plate XL, fig. *g*, 2) the inner metatarsal is long and narrow, with sharp digging edge at right angles to the sole of the foot; base 30° to 50° to axis of longest toe. Outer metatarsal comparatively large, prominent, and having a slight indication of a digging edge continuous with that of the inner.

When all the available material had been examined, it was found that certain specimens from the Cape Flats, Table Mountain, Port Nolloth, Mariannhill, and Robben Island could not be placed under any of the existing definitions. One specimen in the S. African Museum from the Hottentot's Holland Mountains, Caledon Div. (Plate XLII, figs. 5 and 6), resembles *tympanifer* except that the tympanum is less distinct, being practically hidden by granules; the mid-dorsal region is as thickly granulated with porous, crater-like tubercles as the sides, and the ventral surface is more distinctly granulated. There is a distinct swelling on either side behind the eyes, in the region of the parotoid glands.

This specimen seemed to suit the description of *pentheri*, Wern., but for the fact that it says, "Unterseite dicht durch Querfalten gerunzelt, aber nicht granuliert."

On the other hand, it may be the same as that named *verrucosus* by Rapp, notwithstanding that he says "Das Trommelfell verdeckt," for it would be quite easy in this case to overlook the tympanum.

Systematics, if scientific, must take into consideration exceptional specimens even if they differ but slightly from existing forms, for such exceptions are of great importance from a taxonomic, evolutionary, and distributional point of view. Our aim should be to depict the true state of things in Nature, even if thereby our definitions are obscured.

To the six previously described species four new species are now being added. One, for which the name *B. montanus* is proposed, is a small gibbose race nearly related to *B. mossambicus*, but differing principally in the length of the fourth finger, and the more granular appearance.

Another, for which the name *B. rosei* is suggested, resembles *B. gibbosus* in many respects, but differs from it in the more slender habit, in the smoothness of the skin, and, principally, in the dimensions of the pelvis, the length and breadth of which in *gibbosus* are as 4 : 5, whereas in *rosei* the proportions are as 3 : 4·5 (see Plate XLIII, figs. 1 and 2). A third form, from Port Nolloth, Namaqualand, is being called *B. namaquensis*. This species is close to *B. macrops*, but differs principally in the longer fourth finger and the longer toes. A fourth, which resembles *tympanifer* in having a distinct tympanum, is being named *B. rugosus*.

The author recognises three distinct groups arranged according to snout and eye characters :—

- I. The **Gibbosus Group**—*gibbosus*, *rosei*, *fuscus*, *tympanifer*, and *rugosus*.
- II. The **Mossambicus Group**—*mossambicus*, *parvus*, and *montanus*.
- III. The **Macrops Group**—*macrops* and *namaquensis*.

The following are the tabulated results of the examination of all the available material :—

	Number of Specimens examined.	Length of Snout * into Length of Body. †		Length of Fourth Finger as compared with that of the Second.		Diameter of Eye-cleft into Length of Body.		Base of Inner Metatarsal Tubercle to Axis of Longest Toe in Degrees.	Average Size ‡ of Species measured from Snout to Vent in Millimetres.
		From	Average.	From	Average.	From	Average.		
I. { <i>Breviceps gibbosus</i> " <i>fuscus</i> " <i>rosei</i> " <i>tympanifer</i>	14	7 $\frac{3}{8}$ to 10 $\frac{1}{8}$	8.24	to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	.78	9 to 14 $\frac{1}{2}$	10.71	50° to 60°	Males 44-75, females 53-66
	24	6 $\frac{1}{8}$ to 10 $\frac{3}{8}$	7.34	to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	.69	7 $\frac{3}{4}$ to 12 $\frac{1}{4}$	10.59	60°	" 31.77, " 45.66
	1	7		to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	.70	11 $\frac{3}{8}$		30°	" ? " 35.5
	3	6 $\frac{3}{8}$ to 8 $\frac{1}{8}$	7.3	to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	.68	10 to 11 $\frac{3}{8}$	10.87	50° to 60°	" 33.0, " 48.0
II. { <i>Breviceps rugosus</i> " <i>mosambicus</i> " <i>parvus</i>	5	5 $\frac{9}{16}$ to 6 $\frac{3}{16}$	6.28	to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	.44	11 " 13	11.0	40° " 45°	" 33.0, " 33.0
	69	4 " 6	5.11	to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	.60	6 $\frac{3}{8}$ " 11 $\frac{3}{8}$	8.24	40° " 45°	" 33.62, " 46.25
	33	4 $\frac{3}{8}$ " 6	5.10	to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	.8	7 $\frac{3}{8}$ " 11	8.92	30° " 45°	" 24.0, " 28.0
	3	5 " 7	5.83	to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	.44	8 $\frac{1}{8}$ " 9 $\frac{1}{8}$	8.63	30° " 40°	" 30.5
III. { <i>Breviceps montanus</i> " <i>macrops</i> " <i>namaquensis</i>	5	3 $\frac{3}{8}$ to 4 $\frac{1}{8}$	3.78	to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	.70	4 $\frac{1}{8}$ " 5 $\frac{1}{8}$	5.22	Parallel or 30°	32.25
	2	4 $\frac{1}{8}$ " 5 $\frac{1}{8}$	4.72	to 2 $\frac{1}{2}$ to 3 $\frac{1}{2}$		6 $\frac{1}{2}$ " 6 $\frac{5}{8}$	6.66	30° to 50°	40.0

* Measured from a line joining the posterior corners of the eye-openings to the tip of the snout between the nostrils

† Measured from snout to vent.

‡ In some cases general averages only are given, as the lengths of the sexes are not definitely known.

DESCRIPTIONS OF THE GENUS AND SPECIES.

BREVICEPS.

Merrem, Trent. Syst. Amph., p. 178.

Pupil horizontal. Tongue elongate, oval, entire, free behind, tip frequently recurved either superiorly or inferiorly. Palate papillose. Fingers and toes free, the tips not dilated. Outer metatarsals united. Coracoids very much dilated; precoracoids well developed; no omosternum; sternum very small, cartilaginous. Sacral vertebrae with very strongly dilated diapophyses; confluent with coccygeal style. Limbs very short, terminal phalanges simple. An oblique, dark-coloured, fairly broad streak extending from below the eye towards the base of the fore-limb invariably present.

Breviceps gibbosus (Plate XLI, fig. C).

Linné, Syst. Nat., i, p. 211 (1758).

Habit extremely stout. Head very short, scarcely distinct from body; snout truncate (Plate XXXIX, fig. 4), sometimes on a level with a line joining the anterior angles of the eyes, $7\frac{1}{2}$ to $10\frac{1}{6}$ times into length of body. Eyes comparatively small, directed forward, diameter of cleft 9 to $14\frac{2}{7}$ times into length of body; inter-orbital space about equal to the width of the upper eyelid. Tympanum hidden. Fingers and toes rather thickset; fourth finger from $\frac{2}{3}$ to $\frac{8}{9}$ as long as the second; fifth toe fairly well developed; a large, flat, oval tubercle at the origin of each finger and toe, usually a rather indistinct one under the centre joint of the longest toe; palms of hands and soles of feet wrinkled into large folds. Inner metatarsal tubercle very large, thick, and blunt, axis 50° to 60° to that of the longest toe; outer metatarsal large, prominent, scarcely distinct from the inner. Body very rough throughout, covered with rather small tubercles, which are deeply pitted, giving them a crater-like appearance. Ventral surface sometimes finely granular, extremely so submentally, or wrinkled into horizontal folds.

Colour.—Above, olive or a brown sand colour with a mixture of dark and whitish speckles, sometimes with rather indistinct dorsal and lateral stripes; below, a plain dull ochre yellow, sometimes feebly speckled with light brown or vermiculated with reddish brown.

Average length of males 44.75 mm., females 53.66 mm.

DISTRIBUTION :—

Cape Peninsula.—Newlands, Rondebosch, Wynberg and Claremont, Camps Bay, Cape Town.

Breviceps mossambicus (Plate XLI, fig. A).

Peters, Arch. Naturg., vol xxi, pt. 1, p. 58 (1855).

Habit very stout. Head moderately large, quite distinct; snout fairly prominent (Plate XXXIX, fig. 8), measuring 4 to 6 times into length of body. Eye small, diameter of cleft $6\frac{2}{5}$ to $11\frac{2}{3}$ into length of body; inter-orbital space much greater than the width of the upper eyelid. Tympanum hidden. Fingers and toes rather thickset; fourth finger from $\frac{1}{4}$ to $\frac{3}{5}$ as long as the second; fifth toe rudimentary. A large wedge-shaped tubercle at the origin of each finger, a few scattered, rounded, or flat ones on the palms of the hands, rather indistinct subconical ones on the inner sides of the toes; soles of feet smooth. Inner metatarsal tubercle large with long, rather blunt, digging edge at right angles to the sole of the foot, or turned in towards it; base at 40° to 45° to axis of longest toe. Outer metatarsal small and distinct, or fairly large and scarcely distinct from the inner. Body above, quite smooth but porous throughout, or latter half with flat tubercles or granules; sides granular; or whole dorsal surface and sides covered with hard rounded granules or with soft blister-like excrescences. Below, quite smooth, or granular on the abdomen and sides.

Colour variable, but markings fairly constant. The ground colour above may be brown, very dark grey, reddish brown, or light pink, with a large irregular spot on either side of the vertebral line between the arms, two indistinct spots on the centre of the back, four or five irregular lateral spots; these may be light yellow, whitish, pink, or vermillion according to the body colour. A light vertebral line may or may not be present. Below, ochre yellow with spots or vermiculations on the sides of the body and on either side submentally. Occasionally, especially in the males, the whole under-surface of the head is thickly vermiculated.

Average length of males 33.62 mm., females 46.25 mm.

DISTRIBUTION :—

Cape Province.—Kimberley, Grahamstown; Kuruman; Qacu Forest, near Cathcart.

Natal.—Mariannhill; Weenen.

Zululand.—Umlatuzi River.

Portuguese East Africa.—Delagoa Bay; Rikatla.

Transvaal.—Jericho, Pretoria Dist.; Clearwater, Haenertsburg; Shilowane, Zoutpansberg; Barberton; Shahole, near Gravelotte; Hectorspruit, Louw's Creek, Komati-poort; Barberton Dist.; Pietersburg; Mokoetsi River; Rustenburg; White River; Dientje, P.O. Valhoek.

Bechuanaland Protectorate.—Mochudi; Serowe.

South-west Africa.—Kaoko Otavi, Feb. 1926.

Southern Rhodesia.—Hunyan; Bulawayo; Salisbury; Insiza; Mazoe; Bindura, Mazoe Dist.; Eldorado; Empandeni.

***Breviceps macrops* (Plate XLII, fig. 4).**

Boulenger, Ann. Mag. Nat. Hist., (7), vol. xx, p. 46 (1907).

Habit comparatively slender. Head large; snout comparatively long (Plate XXXIX, fig. 1), $3\frac{2}{3}$ to $4\frac{1}{3}$ times into length of body. Eye large, diameter of cleft $4\frac{9}{11}$ to $5\frac{1}{4}$ times into length of body; inter-orbital space narrow, barely half the width of the upper eyelid. Tympanum hidden. Fingers and toes shorter and thicker than in any other species of the genus; fourth finger, and first, second, third, and fifth toes often merely rudimentary stumps; fourth finger from $\frac{1}{3}$ to $\frac{1}{2}$ as long as the second. Palms of hands and soles of feet perfectly smooth or with small, tapering, very soft tubercles at the base, and at each joint of the second and third fingers. Inner metatarsal tubercle feebly prominent, long and narrow, not projecting beyond the side of the foot, parallel to, or at 30° to axis of longest toe; outer metatarsal absent or very indistinct.

Body above, smooth, the head, legs, and arms having a high polish, or latter $\frac{2}{3}$ of the body covered with small, flat, pitted tubercles; below, smooth or skin folded slightly on the abdomen and sides.

Colour above, sandy brown with dark markings, or whitish with faint reddish-brown irregular blotches. A semicircular reddish-brown band passing over each eyebrow and across the forehead in front of the eyes; an irregular curved band from one eyelid to the other across the back of the head; arms, legs, and lower parts white.

Average length 32.25 mm.

DISTRIBUTION.—Port Nolloth, Namaqualand.

***Breviceps fuscus* (Plate XLI, fig. D).**

Hewitt, Ann. Natal Mus., vol. v, pt. 2, p. 191 (1925).

Habit extremely stout. Head very short; snout (Plate XXXIX, fig.

3) very short, $6\frac{1}{3}$ to $10\frac{5}{8}$ times into length of body, not projecting beyond the lower lip, which is vertical. Eyes small, directed forward, diameter of cleft $7\frac{3}{4}$ to $12\frac{1}{4}$ times into length of body; inter-orbital width about equal to the width of the upper eyelid. Tympanum hidden. Fingers and toes short and thickset; feet comparatively short; fourth finger $\frac{2}{3}$ to $\frac{6}{7}$ as long as the second; fifth toe well developed. A large flat or subconical tubercle at the base of each finger and toe, this sometimes semidivided, sometimes very faint, occasionally an indistinct tubercle at the middle articulation of the third finger and fourth toe; palms of the hands with skin folds, giving them a rough appearance; soles of feet smooth, or with very faint, tiny granules. Inner metatarsal tubercle large, very blunt, sometimes quite oval and pebble-like, with no digging edge and having a flat patch worn in the centre. Outer metatarsal a large subcircular pad, more or less distinct from the inner.

Body above, very granular and pitted, especially the top, sides, and under-part of the head; the granules not so thick and more or less regularly spaced mid-dorsally; thickly granular on the sides, upper arms, and legs; chest more or less smooth; granules indistinct on the abdomen.

Colour above, uniform very dark brown, paler on the sides; below, a dull, reddish yellow, except the submental region, which is coloured like the dorsal surface.

Average size: males 31.77 mm., females 45.66 mm.

DISTRIBUTION.—KNYSNA; George.

***Breviceps tympanifer* (Plate XLI, fig. E).**

Hewitt, Ann. Natal Mus., vol. v, pt. 2, p. 190 (1925).

Habit fairly long and stout. Head broad; snout (Plate XXXIX, fig. 5) very short, $6\frac{3}{5}$ to $8\frac{1}{3}$ into length of body, not projecting beyond the lower lip, which is vertical. Eye small, diameter of cleft 10 to $11\frac{1}{2}$ times into body. Inter-orbital width greater than the width of the upper eyelid. Tympanum distinct, vertically oval; diameter about $\frac{2}{3}$ of the eye opening. Body above, porous throughout, densely granulated, but without asperities or warts; below, distinctly granulated but much weaker than on the dorsal surface. Fingers and toes with a large flat, oval or round, rather indistinct pad at the base of each, also an indistinct tubercle at each articulation; palms of hands and soles of feet wrinkled into folds. Inner metatarsal tubercle very thick, short, and blunt, sometimes almost merging into the outer;

projecting beyond the side of the foot ; no digging edge ; axis of base at from 50° to 60° to that of longest toe. Outer metatarsal a large subcircular pad distinct from the inner. Fourth finger $\frac{2}{3}$ to $\frac{3}{4}$ as long as the second ; fifth toe fairly well developed.

Colour.—Above, brown, thickly speckled with dull yellow. Over a broad mid-dorsal area in the anterior half of the body, yellow predominates. A distinct mid-dorsal stripe on the posterior quarter of the body ; this divides into two, just above the vent, which pass along the backs of the legs to the base of the fifth toe. Below, a reddish-yellow or smoky colour, particularly on the abdomen ; submental region pale yellow.

Average length : males 33.0 mm., females 48.0 mm.

DISTRIBUTION.—Pirie, near Kingwilliamstown ; Hogsback, Amatola Range ; Port St. Johns.

Breviceps parvus (Plate XLI, fig. B).

Hewitt, Ann. Natal Mus., vol. v, pt. 2, p. 192 (1925).

Habit short and stout ; head moderately large ; snout (Plate XXXIX, fig. 7) projecting, rather prominent, $4\frac{1}{3}$ to 6 times into length of body. Eye small, diameter $7\frac{1}{3}$ to 11 times into length of body, much greater than the distance between the nostril and the anterior angle of the orbit ; interorbital width about equal to the width of the upper eyelid. Above, quite smooth or with large flat tubercles ; slightly granular laterally. Below, quite smooth or with transverse folds in the abdominal region, slightly granular on the chin ; skin sometimes folded irregularly at the sides ; arms and legs smooth. Fingers and toes slender, bluntly pointed at the tips, a large rounded tubercle at the origin of each finger and toe, a smaller one at each articulation ; fourth finger from $\frac{2}{3}$ to $\frac{4}{5}$ as long as the second ; palmar tubercles large and rounded or finely granular ; soles of feet smooth. Inner metatarsal tubercle kidney-shaped, standing at right angles to, or directed inwards towards, the sole of the foot ; not extending beyond the side of the foot, digging edge rather sharper than in *B. mossambicus*, its axis from 30° to 45° to that of the longest toe.

Colour, slaty grey dorsally with lighter grey spots and blotches at either side of the mid-dorsal line and at the sides. Whitish beneath, often spotted or marbled with slaty grey or greyish black ; a dark oblique streak on the cheek below the eye ; throat and chin dark grey, sometimes almost black, in others speckled with grey.

Total length 28 mm.

DISTRIBUTION :—

Cape Province.—Grahamstown ; Stone Hill, Brok Kloof, Cold-spring, near Grahamstown ; Alicedale ; Port St. Johns.

Zululand.—Mseleni.

Portuguese East Africa.—Lourenço Marques ; Masiene, near Chai Chai.

Transvaal.—Barberton ; Worcester Mine, Barberton Dist. ; Kastrol Nek, Wakkerstroom Dist. ; Louw's Creek ; Komatipoort.

***Breviceps namaquensis*, sp. nov.** (Plate XLII, fig. 3).

This species is founded on two specimens, in the South African Museum, from Port Nolloth, collected by C. L. Biden and W. C. Scully.

Habit comparatively slender. Head large ; snout (Plate XXXIX, fig. 2) comparatively long, $4\frac{1}{3}$ to $5\frac{1}{3}$ times into length of body, projecting slightly beyond the lower lip, which is obtusely pointed.

Eye large, diameter of cleft $6\frac{1}{2}$ to $6\frac{5}{8}$ times into length of body ; interorbital space about half the width of the upper eyelid. Tympanum hidden. Fingers and toes fairly slender ; fourth finger from $\frac{3}{5}$ to $\frac{4}{5}$ as long as the second ; fifth toe fairly well developed ; fingers and palms of hands thickly granulated with small conical tubercles ; third and fourth toes with a small conical tubercle under each articulation ; soles of feet perfectly smooth. Inner metatarsal tubercle distinct but not well developed, having a sharp digging edge, making an angle of 30° to 50° with axis of longest toe ; outer metatarsal narrow and in line with the inner, having a slight indication of a digging edge. Body smooth throughout, or the latter third of the dorsal surface, the sides, abdomen, and submental region finely granular.

Colour above, black or dark reddish brown with a light brown or whitish patch on either side of the vertebral line behind the head, sometimes a whitish bar across the forehead. Two spots on either side mid-dorsally, sometimes followed by a T-shaped mark, and a spot on either side of the vertebral line in the sacral region. The two spots just behind the head sometimes elongate and joined in the centre, forming an H-shaped mark.

The body may be highly polished throughout the whole dorsal surface. Below, uniformly yellowish.

Average length 40 mm.

DISTRIBUTION.—Port Nolloth, Namaqualand.

This species resembles *B. macrops* in size and general appearance. It differs from it, however, in very essential characters, such as the rough hands and longer fourth finger.

Breviceps montanus sp. nov. (Plate XLIII, figs. 3 and 4).

The types of this species are two specimens in the South African Museum, Cape Town, and one in the Albany Museum, Grahamstown, all from Table Mountain, collected by H. W. Oakley, W. L. Sclater, and F. Cruden.

The characters are: Habit short and very stout. Head small; snout (Plate XXXIX, fig. 9) short, but longer than in *gibbosus*, 5 to 7 times into length of body, projecting beyond the lower lip. Eye-opening comparatively large, diameter $8\frac{1}{2}$ to $9\frac{1}{2}$ times into length of body, more than twice the distance from its anterior angle to the nostril; interorbital width about equal to the width of the upper eyelid. Tympanum hidden. Body, arms, legs, hands, and feet densely granular throughout (see figs. 3 and 4, Plate XLIII); those on the dorsal surface being very small, and rather scattered in the mid-dorsal region. Skin without folds. Fingers and toes rather slender, bluntly pointed; the fourth finger $\frac{1}{2}$ as long as the second; fifth toe a mere bud. Inner metatarsal tubercle prominent, oval, and pebble-like, no digging edge; projecting beyond the side of the foot; axis of base 30° to 40° to axis of longest toe; outer metatarsal comparatively large, distinct, or hardly so, from the inner.

Colour, black above with indistinct brownish-grey markings; below, and on the sides, dark ochre yellow; or grey speckled with dark brown on the sides and ventral surface, save the posterior third; or vermiculated with black, thickly so submentally. Specimens a long time in spirit become a uniform yellowish colour.

Average length 30.5 mm.

DISTRIBUTION.—Table Mountain.

This species is near *mossambicus*, from which it differs in the length of the fifth toe and the granulation of the body.

Breviceps rosei sp. nov. (Plate XLII, figs. 1 and 2).

This species is based on a specimen collected on the Cape Flats, at Lakeside, by Mr. Walter Rose. The type is preserved in the M'Gregor Museum, Kimberley.

Habit short and fairly slender. Head moderately large; snout

(Plate XXXIX, fig. 10) rather prominent, 7 times into length of body ; chin obtusely pointed. Eye small, $11\frac{2}{3}$ times into length of body, greater than the distance between its anterior angle and the nostril. Inter-orbital space about equal to the width of the upper eyelid. Fingers and toes slender, tapering towards the tips ; fourth finger $\frac{2}{3}$ as long as the second ; fifth toe but slightly shorter than the second. Inner metatarsal large with blunt digging edge at 30° to axis of longest toe ; outer metatarsal forming a large, hard, subcircular pad, distinct from the inner. Body above more or less smooth with large, very flat, and indistinct blister-like excrescences ; the forehead, subocular region, sides of the head behind the eyes, sides of the body and abdominal region finely granular ; upper surface of the arms and the chin faintly granular ; upper surface of legs and feet quite smooth. Palms of the hands covered with large rounded tubercles, also one at the base of each finger and toe ; soles of feet wrinkled.

Colour, dark above with indistinct brown markings ; a brown patch on the forehead between the eyes, also on the side of the head behind the eyes. Below, whitish, speckled with black on the sides and belly ; submental region and chest thickly vermiculated with black.

Total length 35.5 mm.

DISTRIBUTION.—Lakeside, Cape Peninsula.

This species differs from *gibbosus* in the longer snout, smaller size, angle of metatarsal tubercle, the comparatively slender and smooth body, and the comparative dimensions of the pelvic arch (see Plate XLIII, figs. 1 and 2).

Two specimens from Robben Island in the South African Museum might be referred to this species. The bodies of these latter were so dense that they proved impervious to the X-ray.

***Breviceps rugosus* sp. nov.** (Plate XLII, figs. 8 and 9).

The type of this species is a specimen from Mariannhill, Natal, preserved in the Kimberley Museum. Collected by Br. Felix. Two others from Umbilo, Natal, in the Durban Museum, and two from Maxambuli, Transkei, in the Albany Museum, Grahamstown, also belong to this species.

This species resembles *tympanifer*, Hewitt, in having a distinct tympanum, but the differences between the two forms are considerable.

The characters are : Habit short and extremely stout. Head very small ; snout (Plate XXXIX, fig. 6) fairly prominent, $5\frac{9}{10}$ to $6\frac{3}{5}$ times into length of body ; projecting beyond the lower lip, which is nearly

vertical. Eye very small, diameter 11 to 13 times into length of body; interorbital width about equal to the width of the upper eyelid. Tympanum distinct, subcircular, diameter two-thirds that of the eye-opening. Dorsally, arms and legs with scattered granules, some of which are pitted, sometimes arranged in more or less longitudinal series. Ventrally, with flattened or rounded tubercles distributed throughout, usually small and granular under the head, sometimes fairly smooth on the centre of the abdomen. Skin without folds. Fingers and toes slender, bluntly pointed at the tips; a large blister-like, oval or rounded pad at the base of each finger, smaller and less distinct ones at the base of each toe; a very small tubercle at each articulation of fingers and toes. Palms of hands with large blister-like folds; soles of feet with small, rounded, rather indistinct granules. Fourth finger from $\frac{2}{3}$ to $\frac{3}{4}$ as long as the second; fifth toe fairly well developed. A large and prominent inner metatarsal tubercle, pebble-like, not projecting beyond the side of the foot; no digging edge; lying flat on the sole of the foot or projecting slightly beyond it; a small oval patch sometimes worn flat on the otherwise rounded surface. Outer metatarsal comparatively large, semi-oval, distinct from the inner. Axis of base of inner metatarsal 40° to 45° to that of longest toe.

Colour, a very light brownish yellow or dark grey dorsally, many of the granules being tipped with brown, giving a spotted effect; ventrally, whitish, with sometimes grey vermiculations.

Average length 33.0 mm.

DISTRIBUTION.—Mariannhill, Umbilo, Natal; Maxambuli, Transkei.

Key to the Species.

I. Snout truncate or very short, averages 6 to 8 times into body.

Eye very small, averages 10 or 11 times into body.

- | | |
|---|--------------------|
| a. Tympanum hidden; extremely stout; skin porous throughout and distinctly granular. Average size of ♀ 53 mm. | <i>gibbosus.</i> |
| Tympanum hidden; extremely stout; skin very rough throughout. Average size of ♀ 45 mm. | <i>fuscus.</i> |
| Tympanum hidden; comparatively slender; skin almost smooth dorsally. Size of ♀ 35 mm. | <i>rosei.</i> |
| b. Tympanum distinct; extremely stout; skin porous throughout, densely granular but not rough. Average ♀ 48 mm. | <i>tympanifer.</i> |
| Tympanum distinct; extremely stout; skin with rough scattered granules. Average ♀ 33 mm. | <i>rugosus.</i> |

- II. Snout fairly prominent, averages 5 times into body. Eye fairly small, averages 8 times into body.
- | | |
|---|---------------------|
| Fourth finger $\frac{1}{4}$ to $\frac{2}{3}$ times as long as the second. Smooth ventrally. Average ♀ 46.25 mm. | <i>mossambicus.</i> |
| Fourth finger $\frac{2}{3}$ to $\frac{4}{5}$ times as long as the second. Smooth ventrally. Average ♀ 28.0 mm. | <i>parvus.</i> |
| Fourth finger $\frac{4}{5}$ times as long as the second. Extremely rough ventrally. Average ♀ 30.5 mm. | <i>montanus.</i> |
- III. Snout fairly prominent, 3 or 4 times into body. Eye large, averages 5 or 6 times into body.
- | | |
|--|---------------------|
| Fourth finger $\frac{1}{3}$ to $\frac{1}{2}$ times as long as the second. Palmar region smooth | <i>macrops.</i> |
| Fourth finger $\frac{2}{3}$ to $\frac{4}{5}$ times as long as the second. Palmar region very rough | <i>namaquensis.</i> |

CONCLUSION.

Although there are several instances, in the records given, of closely allied forms occurring in the same locality, e.g. *mossambicus* and *rugosus* from Mariannhill, *macrops* and *namaquensis* from Port Nolloth, they may be separated topographically. The late Dr. L. Péringuey, writing on one occasion to the author, describes the latter locality as follows: "From Port Nolloth to a distance of 12 miles there is nothing but sandhills or sand hummocks *ad infinitum*, and during the dry season they become carpeted with flowers after the first rains. Ograbies, 15 miles north from Port Nolloth, is partly rocky, partly sandy. From Ograbies the sand ceases, and is replaced to Anenous railway station (50 miles from Port Nolloth), where the heavy ascent of the mountain begins, by rocky, grassy, or bushy ground." It is very probable that *B. namaquensis* will be found to prefer the rocky ground inland from Port Nolloth, while *B. macrops* will show a preference for the sandy ground near the coast. The insufficient localisation of their captures by collectors is notorious, consequently records are not always trustworthy.

Agama atra, in the neighbourhood of Kimberley, is confined to the kopjes, while *Agama aculeata* prefers the open veld. This preference for a peculiar type of environment is shared by many other reptiles, batrachians, and mammals.

Dr. Broom,* in a paper entitled "A Contribution to the Knowledge of the Cape Golden Moles," says: "At Stellenbosch they apparently keep certain regions to themselves. Thus, in my garden *C. hottentota* is the species commonly met with, while across the road in the college

* Trans. S. Afr. Phil. Soc., vol. xviii, p. 296 (1907).

quadrangle *C. asiatica* most commonly occurs. It appears probable that *C. asiatica* prefers the drier and sandier soil, and *C. hottentota* the rich garden soil."

Again, Dr. Duerden,* writing of the tortoises of the geometric group, says: "If one were able to study the peculiarities of the environment closely, there is little doubt that the variations would be found to be largely adaptative." Even in very limited areas, such as the Cape Peninsula, one may find a number of quite different environments and climates. An intensive study of such a locality as this, from which closely allied species are recorded, is very desirable. It is probable that *B. montanus* will not be found below certain altitudes of the mountain, *B. rosei* may prove to be confined to the Flats, while *B. gibbosus* would occupy the intermediate area.

* S. Afr. Assoc. for Adv. Sc., Kimb., 1906, p. 205.

EXPLANATION OF PLATES.

PLATE XXXIX.

FIG.

1. Profile of *Breviceps macrops*.
2. " " *namaquensis*.
3. " " *fuscus*.
4. " " *gibbosus*.
5. " " *tympanifer*.
6. " " *rugosus*.
7. " " *parvus*.
8. " " *mossambicus*.
9. " " *montanus*.
10. " " *rosei*.

PLATE XL.

- a. Ventral aspect of hand and foot of *Breviceps parvus*.
- b. " " " " " *gibbosus*
- c. " " " " " *montanus*.
- d. " " " " " *fuscus*.
- e. " " " " " *macrops*.
- f. " " " " " *mossambicus*.
- g. " " " " " *namaquensis*.
- h. " " " " " *rugosus*.
- i. " " " " " *rosei*.
- j. " " " " " *tympanifer*.

PLATE XLI.

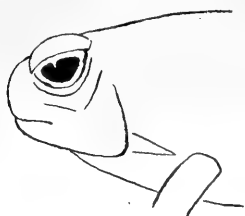
- A. Both sexes of *Breviceps mossambicus*.
- B. " " " *parvus*.
- C. " " " *gibbosus*.
- D. " " " *fuscus*.
- E. " " " *tympanifer*.

PLATE XLII.

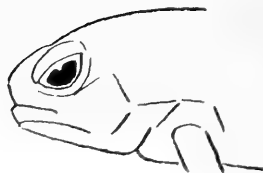
- 1 and 2. Dorsal and ventral views of *Breviceps rosei* sp. nov. Photos by W. Rose.
3. *Breviceps namaquensis* sp. nov., ventral view.
4. " *macrops* Bouleng., ventral view.
- 5 and 6. Dorsal and ventral views of a specimen from Hottentot's Holland Mountains, eastern side.
- 7 and 8. *Breviceps tympanifer* Hewitt, and *Breviceps rugosus* sp. nov., photographed side by side for comparison.
9. *Breviceps rugosus* sp. nov., ventral aspect.

PLATE XLIII.

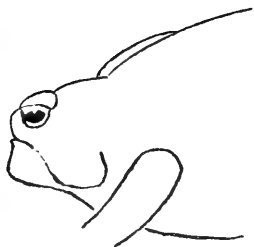
1. X-ray of *Breviceps gibbosus* by W. Rose.
2. " " *rosei* by W. Rose.
- 3 and 4. " *montanus* sp. nov., dorsal and ventral views.



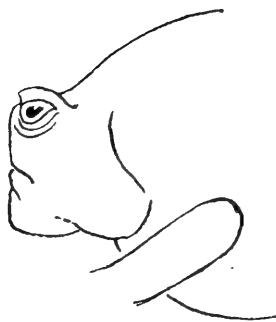
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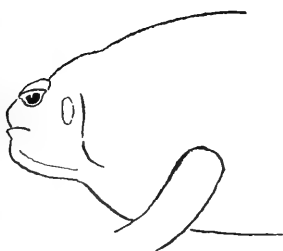
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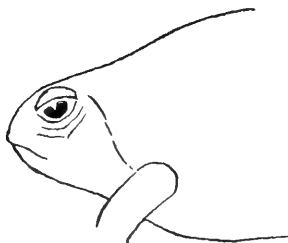
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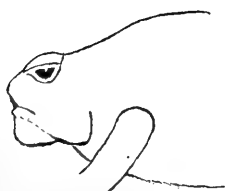
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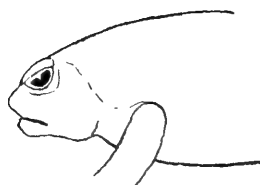
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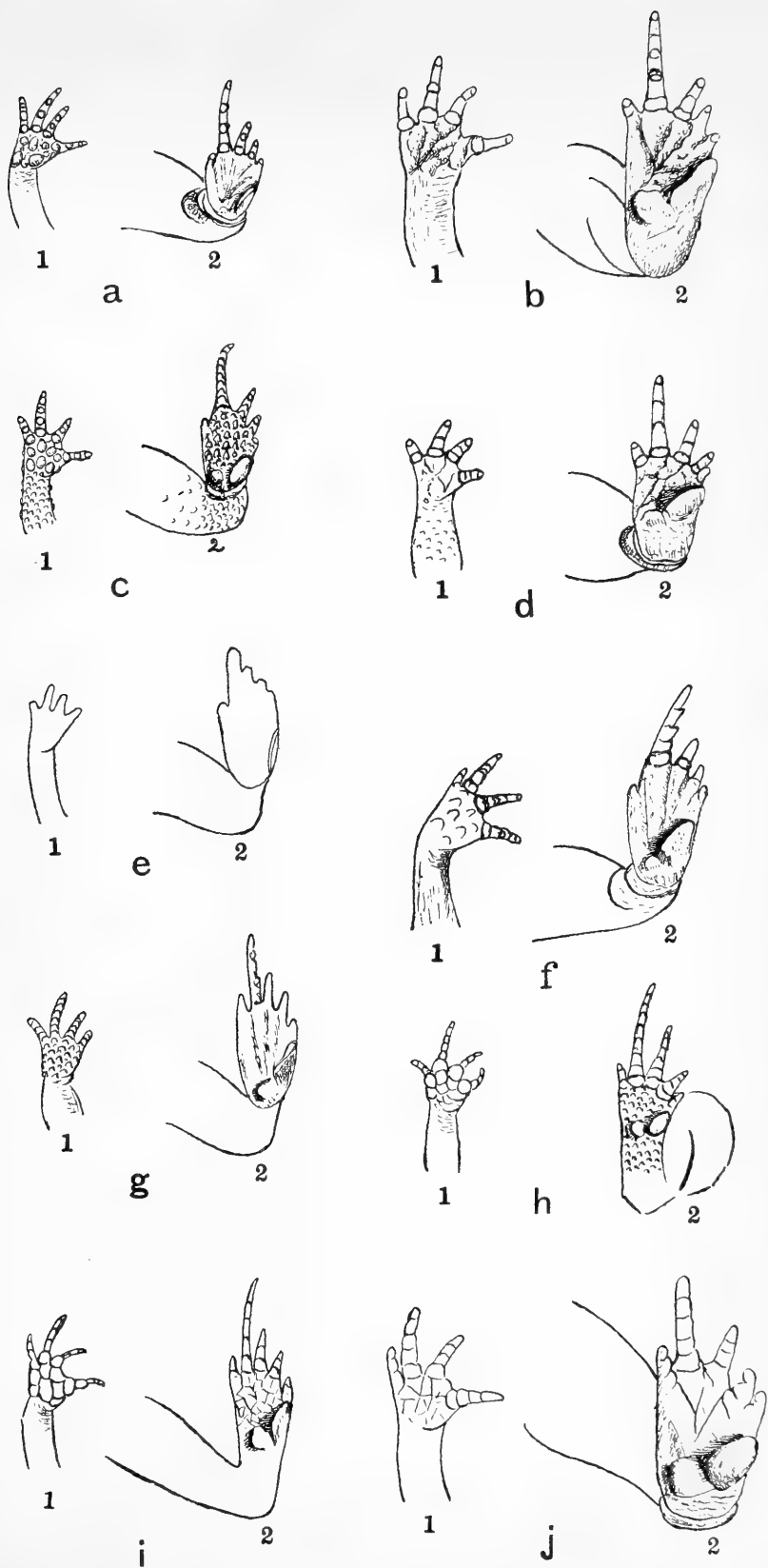
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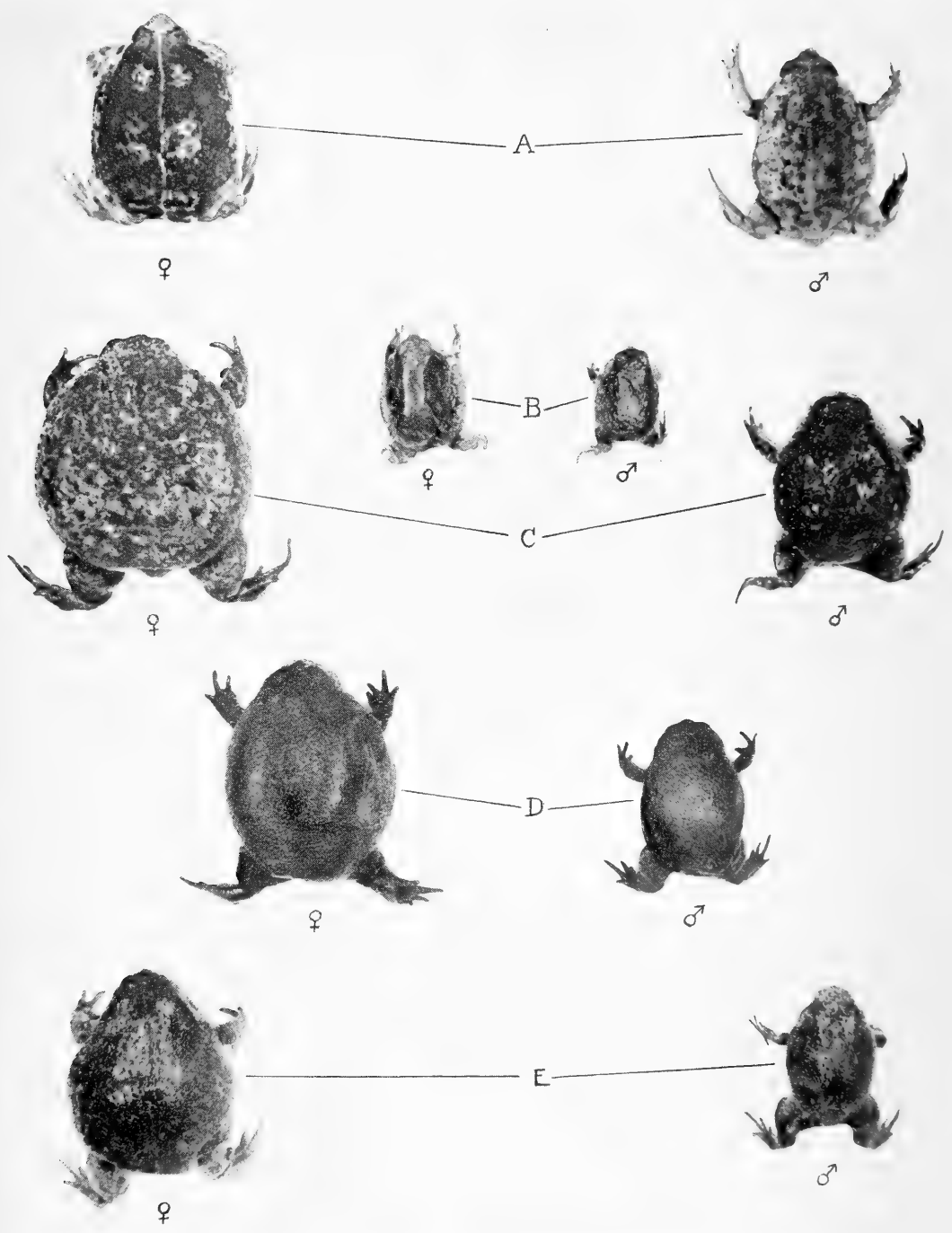


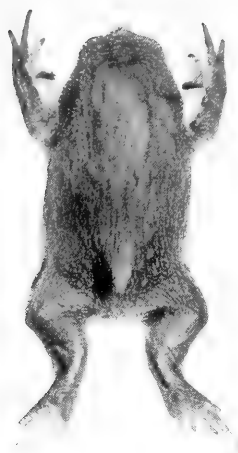
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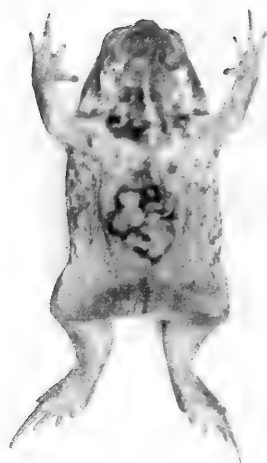
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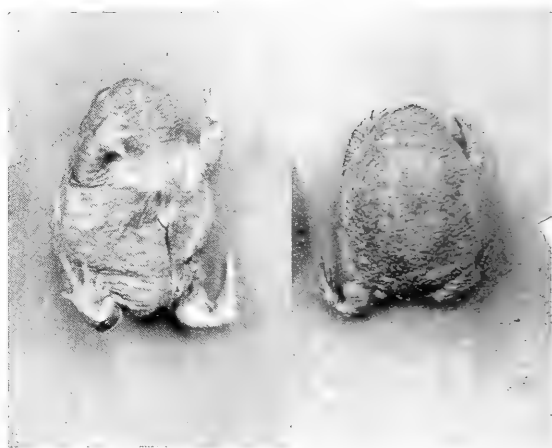


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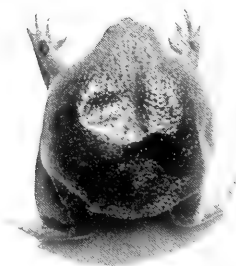


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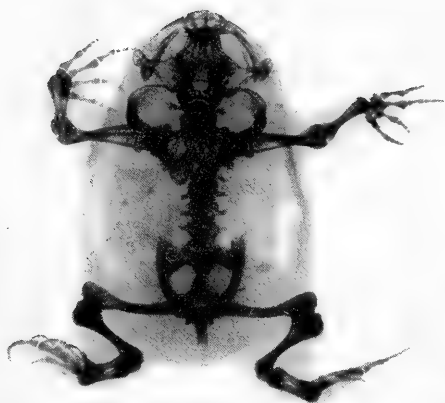
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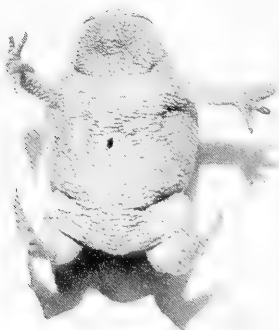
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14. *Some New or Little-known Reptiles and Batrachians from South Africa.*—By JOHN HEWITT.

(With Plates XLIV–XLV.)

OPHIDIA.

Xenocalamus pernasuta (Werner).

Beitr. z. K. Land- u. Süßwasserfauna Deutsch-Südwestafrikas. Reptilia and Amphibia. Hamburg, 1915, p. 358.

I have no doubt but that Werner's genus *Micaela* is opisthoglyphous. A specimen from Warmbad, near Sesfontein, in the collection of the South African Museum, has 4 solid maxillary teeth, the first smallest, and 1 larger grooved tooth a little separated from the last solid tooth; palatine teeth absent; lower jaw with about 8 teeth on each side. Body scales in 17 rows; subcaudals 26, ventrals 223. A small supraocular, triangular in shape; a minute postocular in contact with labials 4 and 5. Upper labials 5, the last much the largest, 3 and 4 entering the eye. Nasal completely divided. Rostral flat below. Parietals forming a short median suture which is not so long as the scale immediately behind it: this character affords a ready means of distinction from *bicolor*.

Upper surface of head and body with slaty infuscation; over the neck and body there are indefinite whitish markings forming obscure cross stripes. Upper lip whitish; 4 outer rows of scales along body on each side whitish, like the ventral surfaces. Rostral dark below. Length 510 mm.

This specimen is therefore not so strongly infuscated as the type of *pernasuta*; also, it has more ventral and subcaudal scales. However, there can be no doubt of the close relationship of the two specimens, and the differences are not likely to be of specific importance.

It may be remarked further that *X. mehovii* has been recorded by F. Nieden from Grootfontein. In the number of ventral and subcaudal scales, the specimen above described is more or less intermediate between *mehovii* and *pernasuta*.

Mr. Lawrence's note on the Warmbad specimen is: "Found under a log in a shallow tunnel only a little wider than the animal, and in

which it seemed able to move backwards or forwards with equal ease. It was rather sluggish, and showed no signs of annoyance on being captured. Living colours, light greenish yellow with brownish-purple markings."

LACERTILIA.

Mabuia homalocephala smithi Gray.

Zoology of Southern Africa : Reptilia, by A. Smith, pl. xxxi, fig. 2.

This form, recorded from "arid districts to the north-east of the Cape Colony," is well distinct from that found near Cape Town, and the habits are different. As stated by Smith, it seeks "concealment under rocks and stones, which generally abound in the places to which they resort"; in the neighbourhood of Grahamstown, *smithi* is decidedly a rupicolous form. It thus differs from the Cape Peninsula form which, as I learn from Mr. Rose, is quite common on the sandy flats near Cape Town, occurring along with *Scapteira knoxi*, but is rare on the mountains.

Smith's specimen is known to me from Dordrecht (R. Essex), Grahamstown (J. Hewitt), Pirie (R. Godfrey), and Gleniffer, Kei Road (G. Ranger). In all these specimens there is a very characteristic broad blackish lateral band, quite uninterrupted by spots; this band starts on the lores and extends to the base of the tail or beyond. The dorsal coloration is not so constant: in Pirie specimens there is no distinct dorsal striping, but all the scales are black-edged: specimens from Dordrecht, Gleniffer, and Grahamstown agree with the type in the presence of seven blackish dorsal stripes—three, however, obsolete in the Dordrecht specimen. Besides, there is a conspicuous pale dorso-lateral stripe and a still more conspicuous lateral one—reddish in life—which passes through the ear. Dorsal scales 3-keeled and likewise the scales on upper surface of tail, but on the tail these keels soon become feeble and even near the base are not very strong, the scales being broader than long, with rounded free margins and not mucronate, the tail itself being somewhat depressed basally. The body also is slightly depressed, the dorsal and lateral surfaces being well demarcated through the characteristic colour pattern.

The Cape Peninsula form referred by Boulenger to *homalocephala*, but evidently that described by Gray as *subrufa*, is not depressed either in body or tail. The upper and lateral surfaces are not demarcated in any way. There is no conspicuous dark lateral band and no dorso-lateral pale band, but the upper and lateral surfaces above the reddish lateral streak present four series of irregular dark spots or

blotches on a brown or olive background. Each dark blotch has one or two pale spots near the hind margin, or in the centre, and the blotches sometimes tend to fuse into broad stripes. Otherwise there are no dorsal streaks, nor are the individual scales dark-margined. The tail is rounded, only slightly depressed near the base, where all the superior caudal scales are strongly keeled, more or less hexagonal in shape, and distinctly mucronate; and strong keels persist up to the terminal third of the tail.

The typical form of *homalocephala* is unknown to me. It may be the same as *smithi*, but the original description omits reference to the blackish lateral band which is one of the most characteristic features of *smithi*, and includes a character—abdomine albido lineis plumbeis picto—not found in that species.

Pachydactylus mentalis sp. nov.

(Plate XLIV, fig. 1.)

Types.—Two specimens in the Albany Museum, Grahamstown, collected at Longhope, on the Great Fish river, by Miss D. Cotton.

The species is closely related to *capensis* Smith, which occurs almost throughout the central districts of the Cape and extends far over the high-veld, but is not known from the eastern districts of the Cape Province, where its place is taken by *maculatus* Smith. It is distinguishable at a glance from *capensis* on account of the markings of the dorsal surface, which considerably resemble those of *maculatus*, but are not quite the same. The most conspicuous structural character of the species is, however, the well-defined row of 5 or 6 chin-shields, which, though not large, are well separated in size from the scales succeeding them. Such chin-shields are not known to occur in any other species of the genus.

Other characters are: Head stout, snout rather obtuse and not depressed; behind the chin-shields are small flattened scales which gradually diminish in size towards the throat; naso-rostrals separated by a single fairly large flattened scale; all the scales over the snout and between the orbits are comparatively large and flattened, but on the occiput are some low tubercles; along a straight line from the naso-rostral scale to the small scales immediately adjoining the orbit about 5 larger scales occur; rostral scale a little broader than deep; keeled tubercles on the back fairly well developed, and between them are small, flattened scales; digits short, the terminal portion not expanded or only very faintly so; subdigital lamellae 3, but in addition

is a smaller divided terminal lamella; scales along middle of toes inferiorly not enlarged, except distally, about 9 such scales being present on the middle toe from its base up to the first lamella; tail elongate and tapering, more or less distinctly ringed, some of the larger scales on the upper surface near the base of the tail being slightly keeled.

On each side of the head a curved dark band, starting in front from the nostril and extending back to the occiput, where it nearly meets its fellow. Dorsal surfaces of neck and body with dark blotches; these are arranged somewhat indefinitely, but can be referred to four rows, the two median rows largest, and the blotches of these rows more or less merging on the hinder half of the body. Tail with irregular spots.

Length from snout to vent 36 mm.

The possibility of these specimens being merely hybrids between *capensis* and *maculatus* has been considered. On the colour pattern this might seem not improbable, but some of the structural characters are against such interpretation. In *maculatus* all the head scales are granular, and likewise those of the gular region, the granules nearest the mental scale being smaller than those a little posterior thereto. In *capensis* the scales adjoining the mental and first labial are small and flattish, but a little larger than scales more posteriorly situated: thus, in this respect, *capensis* is intermediate between *maculatus* and the species now described. On the other hand, *capensis* is by no means constant in its characters throughout the wide area of its range; in a specimen from the White River, Eastern Transvaal, the scales on the snout and the gular scales are decidedly smaller than in typical specimens from Kimberley, thus approaching a little towards the *maculatus* condition. This White River specimen is perhaps referable to the form described by Boulenger from the Rustenburg district as *affinis* (Ann. Mag. Nat. Hist., vol. vi, pt. 17, p. 21), from which again I think it will be difficult to distinguish the Zoutpansberg form, *tigrinus*, van Dam (Ann. Transvaal Mus., vol. vii, pt. 4, 1921): I do not know what are the characters of *affinis* in this respect, but in specimens of *tigrinus* from Njelele River the scales adjoining the mental and first labial are finely granular. Probably the distinction of this latter form rests mainly on the naso-rostral character, for in the type of *affinis* the naso-rostrals are said to be separated by a granule. I may add that in young and immature specimens from Njelele the dorsal surfaces are nearly homogeneously scaled, the tubercles being not much bigger than the scales that accompany them, and not raised up, though keeled to some extent.

Pachydactylus punctatus subsp. nov. *bicolor*.

(Plate XLIV, fig. 4.)

Types.—Two specimens in the collection of the South African Museum (No. 17297), collected at Kaross, in the Kaokoveld, S.W.A., by Mr. R. F. Lawrence. These specimens are possibly immature and their characters a little uncertain, but the very striking colour pattern seems to warrant a distinctive name for the form, especially as there are minor structural peculiarities—the number of labials, etc.

The characters are as follows: Nasorostrals in contact, nostril well separated from rostral and first labial, rostral twice as broad as high, 8 upper labials, 7 quite distinct lower labials, snout scarcely more than $1\frac{1}{2}$ times as long as the eye; scales on the snout twice as large as those on occiput; a swelling above the loreal region on each side of the snout; symphysial shield nearly twice as long as broad; ventral scales larger than the dorsals; a circular area just in front of the vent with considerably enlarged scales, which are separated by much smaller scales from the strip of enlarged scales under each thigh; dorsal scales not very strongly flattened; distal expansion of digits with 5 adhesive lamellae, the most distal lamella smallest and divided in the middle; scales along the middle of the digit inferiorly all transversely enlarged.

Colour.—Head above greyish white, with some dark mottlings, and surrounded by an elliptical blackish stripe which arises at the nostril and passes backwards through the eye on each side and around the back of the occiput; this stripe is bordered behind by a white stripe arising on the upper lip and broadening a little over the neck; forelimbs and greater portion of dorsal surface of body quite black, but changing suddenly to greyish white over the lumbar region; a dark transverse patch or band between the hind-limbs dorsally; hind-limbs and base of tail greyish white, the tail with faint dark cross stripes.

Length from snout to vent 25 mm.; tail imperfect.

Mr. Lawrence informs me that he noticed this gecko at other localities (Warmbad and Caimaeis), and that all specimens seen were similar in colour and size to those above described. They were found under logs or amongst decaying leaves.

Dr. Werner has given some notes on the coloration of the young of the related species, *brunnthaleri*, from which it is evident that the form now described cannot be referred to that species. It is, however, possible that fully adult specimens may be differently marked from

the types : that such is the case in *purcelli* was pointed out by Methuen and myself in Annals Transvaal Museum, vol. iv, p. 132, fig. 15, 1913. *P. serval* Wern., from Chamis in Great Namaqualand, seems to differ in the higher rostral and the greater number of subdigital lamellae (6), as well as in coloration, but the characters of immature specimens are unknown.

Lastly, *P. pardus* Sternf., from Warmbad, the only other western species of this group, differs in the greater number of labial shields (10-11 and 9) and in the rostral entering the nostril. Although the type locality is not more fully indicated, I presume that the particular Warmbad is that in the south of Great Namaqualand.

Pachydactylus punctatus brunthaleri Wern.

Three specimens from Narebis, 40 kilos. west of Otjiwarongo. I do not hesitate to refer these specimens to the same species as that found at Serowe and near Bulawayo, although the eye is a trifle larger. Werner himself has recorded *brunthaleri* from Grootfontein and Okahandja. I believe that this form is best regarded as a long-snouted subspecies of *punctatus* Ptrs.

Lygodactylus lawrencei sp. nov.

Type.—A single specimen in the collection of the South African Museum (No. 17289), collected at Otjitambi, Kaokoveld, S.W.A. This species is perhaps related to *L. ocellatus* Roux, which is fairly common in the Eastern Transvaal. In both the mental scute is entire.

L. lawrencei has the following characters : Three well-developed pairs of subdigital lamellae, and a smaller fourth pair distal thereto ; snout rather stout and broadly rounded, the canthus rostralis quite lacking (in *ocellatus* it is pointed) ; supraorbital region well raised ; nostril well separated from rostral, the scales surrounding the nostril all comparatively small, comprising 3 nasals and the first labial, which is much smaller than the second labial (larger than the second labial in *ocellatus*) ; anterior nasals separated by two scales ; rostral hardly $1\frac{1}{2}$ times as broad as deep (at least twice as broad as deep in *ocellatus*) ; mental not so large as in *ocellatus*, and in contact posteriorly with two scales, which, like the scales adjoining them laterally, are only a little larger than the scales immediately posterior to them, and in diameter are only about twice that of the smallest scales on the throat (in *ocellatus* diameter of a chin-shield is quite four times that of a small scale on the throat) ; a single pair of rather large preanal pores.

Tail with only base remaining, but apparently none of the inferior caudal scales are much larger than the rest.

Colour.—Dorsal surfaces ashy grey with a number of thin blackish streaks, most of which are more or less broken up. The best developed is one which starts from the eye and passes backwards well above the ear-opening, gradually thickening towards the shoulder, where it ends abruptly; another blackish streak arises from the eye a little superiorly, and passes backwards without thickening along the dorsolateral region of the body. Another thin streak arises from the gape, passes backwards through the eye-opening to the base of the fore-limb; another streak arises along the mid-line of the occiput and over the neck bifurcates, the two continuing along the length of the body in broken condition. A thin V-shaped streak across the head between the orbits anteriorly. A streak from the nostril to the eye. Two V-shaped streaks on the throat, and a streak along the lower lip on each side which is continued backwards to a point below and slightly beyond the ear-opening. There are infuscated patches also on ventral surfaces of thighs, and in front of the anus around the preanal pores, but the pore-bearing scales are whitish and thus at once visible to the naked eye.

Length from snout to vent 26·5 mm.

Eremias namaquensis subsp. nov. *quadrangularis*.

Type.—A specimen from Kalkfontein (South, S.W.A., in the South African Museum (No. 16128), collected by Mr. J. S. Brown. It is characterised by a long slender snout; dorsal surfaces with 5 continuous white stripes, the central one bifurcating on the nape, and posteriorly passing into the median pale area over the base of the tail; this mid-dorsal stripe is a trifle broader than the stripe on each side of it, from which it is only narrowly separated; interparietal shield 4-sided, broad in front, nearly as broad as the frontal, its anterior angle obtuse; parietals in short contact; prefrontals in contact. Length from snout to vent 50 mm., length of head 10·4 mm.

Two other specimens from Warmbad, near Sesfontein, are similar, but the dorsal stripes are lacking; in one of them, the prefrontals are separated by a small azygos scale which is longer than broad; in the other, the parietals are separated; in both, the interparietal is broad in front, narrowing greatly behind.

The same form is also known to me from the Kalahari-Kyky and Lower Molopo north of Zwart Modder (Miss M. Wilman). In these specimens, the prefrontals may be separated or in contact; the parietals

are usually separated ; but the interparietal seems distinctive, being very broad in front and narrow behind, the anterior width being not much less than that of the frontals.

The typical form of *namaquensis*, as inferred from the descriptions of Smith and Boulenger, has four white stripes down the back, the interparietal is not nearly so broad as the frontal, and its anterior angle is generally less than a right angle, the parietals are not in contact, the prefrontals are separated by an azygos scale, and the snout is not so strongly pointed as in the form just described. The V-shaped anterior portion of the mid-dorsal stripe is present immediately behind the head, and in young specimens a trace of it may continue along the back.

In a baby specimen from De Aar, both prefrontals and parietals form median sutures : another juvenile specimen (16146 S.A.M.) has the prefrontals in contact.

This typical form is known to me from Graaff Reinet, Victoria West, Middleburg C.P., Beaufort West, Hanover, and Cradock. The Cradock specimen is peculiar in possessing 5 pale dorsal stripes, the middle one a trifle narrower than its neighbours ; the head-scaling is quite typical, however.

According to Boulenger, another western form to be included under *namaquensis* is *breviceps* Sternf. from Walfish Bay (Mit. a.d. Zool. Mus. Berlin, vol. v, p. 404, 1911) : this form is only known to me from Sternfeld's description, which seems to indicate a distinct species if only on the characters of the tympanic scale. It is in any case well distinct from the form now described.

Eremias burchelli D.B.

In distinguishing this species from its ally *E. capensis*, the following characters seem to me of importance : Snout comparatively elongated, frontonasal separated from rostral or occasionally only just touching the rostral, this frontonasal scute being always broader than long ; whereas in *capensis* it is as long as broad or even longer than broad ; four pairs of chin-shields ; back with granular scales of uniform size. It is a common species on the Zuurberg Mountains near Grahamstown, and is also known to me from mountains or mountainous regions near Indwe, Dordrecht, Queenstown, Majuba Nek (Herschel district), and Maclear. Our material agrees sufficiently well with Smith's figure and description, although his specimens were said to come from "Karoo flats on the south-west coast of Africa, particularly Little Namaqualand." I think there must be a mistake in this locality

record, for it seems very unlikely that the same form can occur both on the eastern mountains and on the flats of Namaqualand. Smith's figure almost exactly matches an adult male from Queenstown recently collected by Mr. R. Essex; a male from Maclear is similar, but the two lateral thin white stripes are obsolete except in the neck region.

The dark markings of the upper surfaces are referable to 6 longitudinal series, the median pair being very narrow; there is also the commencement of a seventh blackish stripe immediately behind the occiput mesially, and a ventral dark stripe on each side below the lower white stripe. In adults these stripes and bands more or less break up, especially in the males; but in juveniles they are all very distinct and the coloration pattern presents 7 thin white stripes on a blackish background, the median white stripe bifurcating on the nape and fading somewhat on the hinder part of the back, whilst the stripes on either side of it remain as widely separated from each other as from the dorsolateral stripes. In adults the dark pigmentation may disappear over the mesial region of the back, and sometimes, as in a female from Queenstown, the upper surfaces are quite devoid of black; in this specimen the colour above is uniformly dull brown with 5 very faint thin pale streaks, the middle one, though much broken up, extending the whole length of the body and bifurcating on the nape, whilst along the flanks is a continuous and conspicuous thin white streak which commences below the eye and extends to the hind-limb, the under-surface of the tail tinged with pink. In all specimens from the eastern districts of the Cape the two median black stripes, when present, remain separate from each other throughout the length of the back, or they may fuse above the pelvic region. Two immature specimens from Nemahedi Camp, Basutoland (J. Cottrell) can also be referred to the Eastern subspecies.

There is a distinct form of this species in the Western Province of the Cape which I now describe as *Eremias burchelli quinque-vittata* subsp. nov. (Plate XLV, figs. 1, 2, and 4.)

Type.—A single sub-adult female specimen in the South African Museum, Cape Town (No. 14342), collected on the Matroosberg by the late R. M. Lightfoot.

The chief distinguishing feature lies in the two black mid-dorsal stripes which are not parallel over any part of their length, but gradually converge until they meet just behind the shoulders; the single stripe then continues unbroken to the base of the tail, where it ends

abruptly. The other two bands on each side are well defined, but contain numerous white spots which tend to fuse together, so that each band has a white centre much broken up, and black margins. The two lateral white stripes on each side are well developed throughout their length, the more dorsal one extending backwards well on to the tail. Thus, over the middle of the back, the dorsal and lateral surfaces present 6 white streaks, the two middle ones rather near together, as they are throughout the hinder half of the body. Limbs with conspicuous white spots above. About 63 scales across the middle of the body. These are all flat and not quite uniform, for those over the white stripes are slightly but distinctly larger than the adjoining scales; on the back, the largest scales are those over the dorsolateral white stripes. Only three scales in a line between loreal and first supraocular. Four pairs of chin-shields. Ventral plates in 14 longitudinal series.

Measurements.—Snout to vent 54 mm., fore-limb 20 mm., hind-limb 32 mm., snout to tympanum 12.5 mm., breadth of head 9 mm.

An adult male (Plate XLV, fig. 4) of larger size from the same locality is coloured as follows: Dorsal surfaces grey with irregular blackish markings on the back, the most conspicuous of which border on the dorsolateral pale streak; over the neck are 5 inconspicuous thin pale streaks all black-margined; the median one is very short, ending on the neck; the next pair, also rather short, converge throughout their length, but end abruptly without actually fusing just behind the shoulders; the dorsolateral streak on each side persists throughout the length of the body and extends a short distance along the tail. Faint traces of a pale lateral streak also occur.

Limbs with black and white ocelli. Five pairs of chin-shields. Femoral pores 15. Length from snout to vent 58 mm.; length of tail 117 mm. Scales all of uniform size on the back; about 64 in a transverse line across the middle.

A young male (Plate XLV, fig. 1) has 5 white streaks on a blackish background dorsally; the median streak ends just behind the shoulders; the next pair converge very gradually, running close together for some distance and ultimately fusing just above the pelvic region; the dorsolateral pair continue well into the tail. The black bands adjoining the dorsolateral white streak on both sides contain numerous small white spots. A white lateral streak is also present. Limbs conspicuously spotted with white.

The colour pattern of this specimen is uncommonly like that of juvenile *capensis* from Victoria West. In all three specimens the

anterior supraocular is large, being almost as long as broad, and the scales between it and the loreal not broken up into small granules as in typical *burchelli* or *capensis*. The prefrontals in the adult male form a moderately long suture: in the female, they are separated by a small azygos shield; in the young male, the frontal and frontonasal are just in contact.

Lacerta australis sp. nov.

(Plate XLV, fig. 3.)

Type.—A single specimen collected on the Matroosberg by the late R. M. Lightfoot: No. 14741 in coll. South African Museum.

Head somewhat depressed, body scarcely so. Depth of head slightly exceeding the distance from end of snout to anterior border of eye. Occipital region flat; snout pointed, but shorter than postocular part of head; length of pileus very slightly exceeding twice the width. Neck as broad as head. Adpressed hind-limb reaching the collar. Foot about as long as head. Nostril pierced between the nasal and postnasal, and scarcely separated from first labial; on the left side there are two incomplete postnasals. Nasals forming a suture behind the rostral; frontonasal broader than long; frontal about as long as its distance from the end of the snout, broader in front, about $1\frac{2}{3}$ times as long as broad, posteriorly decidedly narrower than the supraoculars, the two long sides almost straight; parietals about $1\frac{1}{3}$ times as long as broad, outer border for the most part straight, in front forming a good contact with the small fourth supraocular but not meeting any of the small postoculars. First supraocular smallest, not in contact with the frontal. Of the two major supraoculars the first is longer; 6 supraciliaries, the suture between first and second oblique; a series of 9 granules between supraoculars and supraciliaries. No foramen in the interparietal. Occipital broader than the interparietal, and hardly more than $\frac{1}{3}$ as long. Rostral not entering the nostril. Two loreals, first shorter than second. Four upper labials anterior to the subocular, the lower border of which is considerably shorter than the upper. Lower eyelid pigmented over an extensive area, and some of the scales thereon more or less vertically enlarged, but irregularly so. Temple covered with granular scales similar to the dorsals; an elongated upper temporal scale followed by three smaller ones; an elongated tympanic scale; 5 or 6 postocular scales, the largest being that adjoining the subocular; no masseteric shield. Ear-opening large. No pterygoid teeth. Collar even-edged, composed of 8 plates, in contact

with which is a row of about 6 enlarged scales ; from this row to the symphysis of the chin-shields a straight line includes about 30 scales ; a gular fold present.

Dorsal scales all granular and smooth like the laterals, about 68 mm. across the middle of the body. Ventral plates with rectilinear border, feebly imbricate, in 6 longitudinal series, the second series on each side from the median line a little broader than the outer series, especially anteriorly, the median series narrowest ; 28 transverse series are present, counting from the row of obliquely elongated scales just behind the collar.

A large preanal plate, in front of which are several other enlarged scales of smaller size ; two of these mesially situated are larger than their fellows, so that the condition might be described as a longitudinal series of 3 preanal scales, the hindermost largest. Scales on upper surface of hind-limb all granular, but along the anterior surface of the thigh is a row of about 7 much enlarged and vertically elongate scales which are quite smooth ; adjoining these above and below are scales of smaller size. Fore-limb with enlarged smooth scales on upper and anterior surface of humerus. Strongly enlarged scales also occur on anterior surface of fore-arm, and on ventral surface of leg ; small scales considerably larger than the dorsal granular scales occur on ventral surface of thigh anterior to the line of femoral pores. Otherwise, the scaling of the limbs resembles that of the dorsal surface.

16-19 femoral pores on each side.

Under the fourth toe about 23 scales.

Tail with enlarged scales ; dorsally, near the base of the tail, these are all long, narrow, and smooth or faintly keeled, but more distally they become definitely keeled ; this is also the case ventrally, but the keeling is more pronounced and the posterior border of each keeled scale is pointed, though not acutely so, and the broader smooth scales near the base of the tail have quite straight posterior borders. The caudal whorls are, on the whole, uniform in length ; near the base of the tail the scales become gradually shorter, the dorsal ones merging into those of the back.

Colour (preserved specimen).—Dorsal and lateral surfaces of body and limbs blackish, with numerous regularly arranged small pale-green spots ; upper surface of head freckled with pale green ; temporal region with indication of vertical pale-green stripes ; tail obscurely spotted. Lower surfaces blue-green ; upper and lower lips, chin-shields, and throat pale green with small black spots. The spots of the dorsal surface are more or less in longitudinal lines, and over the

neck and shoulders those mesially situated form a thin broken median streak.

Length from snout to vent 41 mm., length of head 10 mm., width of head 6.5 mm., depth of head 5 mm., length of fore-limb 13 mm., of hind-limb 22 mm.

This species can be arranged in the *Podarcis* group as defined by Boulenger, and is apparently related to *danfordi* of Asia Minor and Greece. It resembles the three other African species in the absence of the parietal foramen, but is at once distinguished by the small size and greater number of the dorsal scales; these three species differ so much from each other that Boulenger referred them to three distinct sections of the genus. In the future revision of the genus it is probable that the African species will be recognised as belonging to one natural group.

L. australis seems to be the first record of this genus as endemic south of the tropic of Capricorn. The other African species are only known from the equatorial region. There is, however, a record of *L. dugesii* from Table Mountain (R. Sternfeld in Mit. a. d. Zool. Mus. Berlin, vol. v, p. 403, 1911); but this was suspected to be an accidental importation from Madeira.

Tropidosaura montana subsp. nov. *rangeri*.

(Plate XLIV, fig. 3.)

Type.—A single adult male example in the collection of the Albany Museum, taken on the farm Gleniffer, near Kei Road, by Mr. Gordon Ranger, November 1925. The habitat is grass-veld.

It closely resembles the typical form of *montana* in the head-scaling, but differs as follows: Frontal scute 5-sided, the posterior transverse edge being only slightly curved; interparietal 4-sided, broad in front, $1\frac{1}{2}$ times as long as broad; occipital of moderate size, quite half as long as the interparietal. In *montana* the frontal is 6-sided, interparietal 5-sided and elongated, occipital small, not half as long as the interparietal.

Colour.—Fore-part of head blackish, parietal scutes brown, dorsal surface of body brown with faint traces of darker mid-dorsal stripe. A continuous and conspicuous cream-coloured dorsolateral stripe arising immediately behind the head, flanks blackish, divided by a second cream-coloured stripe, which arises on the upper lip just below the eye, is broken in the axillary region, and not sharply defined on the flanks; a conspicuous ventrolateral stripe of orange spots on

each side of the body; ventral scales creamy white with blackish edges, mental region blackish.

From snout to vent 50 mm., tail 113 mm.

Rangeri may be considered a brachycephalic form of *montana*; geographically it is the extreme eastern form. In the matter of altitude there is nothing to distinguish them, for *montana* has a great altitudinal range. I have recently taken it on low hills near the sea at Hamburg, C.P.

BATRACHIA.

Bufo tradouwi sp. nov.

Types.—A series of specimens in the collection of the South African Museum, taken on the Swellenden Mountains and in Tradouw Pass at 3500–5500 feet altitude by Dr. K. H. Barnard, 1925.

This species is closely related to *B. rosei*, differing therefrom chiefly in the presence of a well-developed tympanum, which, even in juvenile specimens, is quite distinct; it is also larger than *rosei*.

Toes long, not distinctly pointed, without web at the base and without lateral fringe; subarticular tubercles moderate, more distal ones on two longer toes double, or with indication of doubling; metatarsal tubercles not strongly developed. No tarsal fold; tarsal region with several weak tubercles. First and second fingers subequal. Tympanum well developed, about $\frac{2}{3}$ the diameter of the eye. Parotoids generally prominent, tapering in front and behind, with comparatively few and large pores; also along the dorsolateral white stripe are one or two much smaller parotoid-like skin glands near the lumbar region, but these are sometimes ill-developed; further, just behind the angle of the mouth, is a parotoid-like skin-gland. Dorsal surface of body with numerous rather small, mostly rounded, smooth warts; these extend to the head, but are absent over the snout. No asperities except occasionally in the coccygeal region. A few smooth warts on outer side of hind-limb. Vertebral line distinct or otherwise; absent over the head. Abdomen smooth or nearly so. Hind-limb pressed forward; the tarso-metatarsal joint reaches the middle of the eye, or to front of orbit in smaller specimens.

Colour.—Dorsally blackish or dark brown, with 3 conspicuous pale stripes. The lateral stripes commence at the parotoids and extend back to the inguinal region; the median stripe commences on a level with the anterior margin of the orbits. Parotoids generally with reddish tinge, which also characterises the small glands more posteriorly situated. Ventrolateral region and upper lip with black and

grey reticulation. Ventral surfaces whitish with fine blackish reticulation over the belly; this, however, is variable.

Length from snout to vent 31.5 mm.; breadth of head 11 mm.

I have also a single specimen of this same species from George Mountain (Mr. J. E. H. Mylne).

This species agrees with *rosei* in that the parotoids are situated on the sides of the neck rather than on the upper surface, as in *angusticeps*; thus, these glands are somewhat laterally compressed rather than depressed.

Key to S. African species of Bufo, group angusticeps Smith.

1. Toes pointed, generally well webbed at the base and narrowly fringed with web almost up to the tip (sometimes fringe along toes obsolete); parotoids elongated; belly smooth. [Coastal region from Cape Town to Mossel Bay.] *angusticeps* Smith.
2. A more slender form; toes longer, not so well pointed, webbed at the base, but less distinctly fringed with web; tubercles under digits and on soles not strongly developed; tarsal fold present though ill-developed. [Amatola Mountains] *amatolica* Hewitt.
3. Toes not pointed, only slightly webbed at the base, and not or scarcely fringed with web; tubercles on soles and tarsi all well developed, and likewise also the tarsal fold; parotoids usually broad. (Young considerably resembling *amatolica*, but distinguishable on the webbing of the feet and in the stronger development of the foot tubercles; in smaller specimens, subarticular tubercles may be entirely single as in *amatolica*, but in half-grown examples some of the tubercles are doubled; chest with numerous irregular black spots and sometimes a few on the throat.) [Occurs in all the central districts of the Cape Province from Steinkopf to Queenstown.] *gariensis* Smith.
4. Toes long, not webbed; foot tubercles not strongly developed, and no tarsal fold, some of subarticular tubercles double or with indication of doubling; parotoids pointed behind and in front; surfaces generally free from asperities. [Swellendam Mountains and George.] *tradouwii* sp. nov.
5. Similar to *tradouwii*, but tympanum quite absent. [Muizenberg.] *rosei* Hewitt.

Bufo dombensis Boc.

Three specimens from Outjo and Sesfontein. These are much smoother dorsally than either *vertebralis* or *fenoulheti*. One specimen is quite free from dorsal asperities; in two of them there are scattered asperities over the back, but in all the head is entirely smooth above.

There is a continuous vertebral line. Parotoids flattened, in one example divided almost as in *vertebralis*.

Length 36 mm.

Phrynomantis nasuta Hewitt and Methuen.

Two specimens from Outjo : " Found lying in little round hollows in the sand beneath stones."

These agree in most respects with the type and only known specimen from the Great Karas Mountains, but there are minor differences. Tympanum rather indistinct. Fingers slightly more dilated at the tips. Throat more or less infuscated. The markings over the middle of the back take the form of two irregular ocelli instead of two irregular longitudinal bands. Inner metatarsal tubercle fairly prominent but not shovel-shaped. Total length 33.5 mm.

The relationship of this species to *annectans* Wern. must remain doubtful until adult topotypes of the latter become available.

Cassina wealii Blgr.

Brit. Mus. Cat. Batrachia, p. 131, pl. xi, fig. 7, 1882.

Mr. G. A. Ranger has recently sent to me three specimens from Gleniffer, Kei Road, which agree well with Boulenger's description. All recent authors, including Boulenger himself, have regarded this species as a synonym of *senegalensis* D.B., and Noble, who has examined a large series of *Cassinass*, remarks : " I can find no distinguishing character of *wealii* which is not present in our series of *senegalensis*, and I have not hesitated in uniting these two species. . . . I have compared a specimen of *senegalensis* from Cape Colony with our large series from Niangara and can find no differences of any kind."

The following characters seem to warrant specific recognition for *wealii* : Belly entirely granular—in *senegalensis* only the hinder portion is granular ; adult male with a round or transversely oval prominent disc on the throat, well defined posteriorly as well as laterally, and with no regular plaits on the throat—in *senegalensis* the disc is longitudinally elongate, its posterior margin is ill-defined, and behind it the throat is strongly and regularly plaited ; outer metatarsal tubercle rather large but flattened and not sharply defined—in *senegalensis* very small but well defined.

C. wealii is known to me from Gleniffer, near Kei Road, and from Grahamstown, where also *senegalensis* occurs. The local distribution of the two species near Grahamstown has not been worked out, but

it is known that *senegalensis* inhabits the drier open flats above the town, whilst *wealii* has been taken on the humid mountain slopes south of Grahamstown near Stones' Hill.

C. senegalensis is known to me from Grahamstown, Mariannhill, Natal, Port St. Johns (N. Gould), Zululand (H. W. Bell Marley), Matoppos (J. Cockcroft). The Grahamstown form is possibly worthy of separation as a distinct subspecies, for the ventral surfaces are less strongly granulated than in the other specimens examined; it is moreover larger in body.

EXPLANATION OF PLATES.

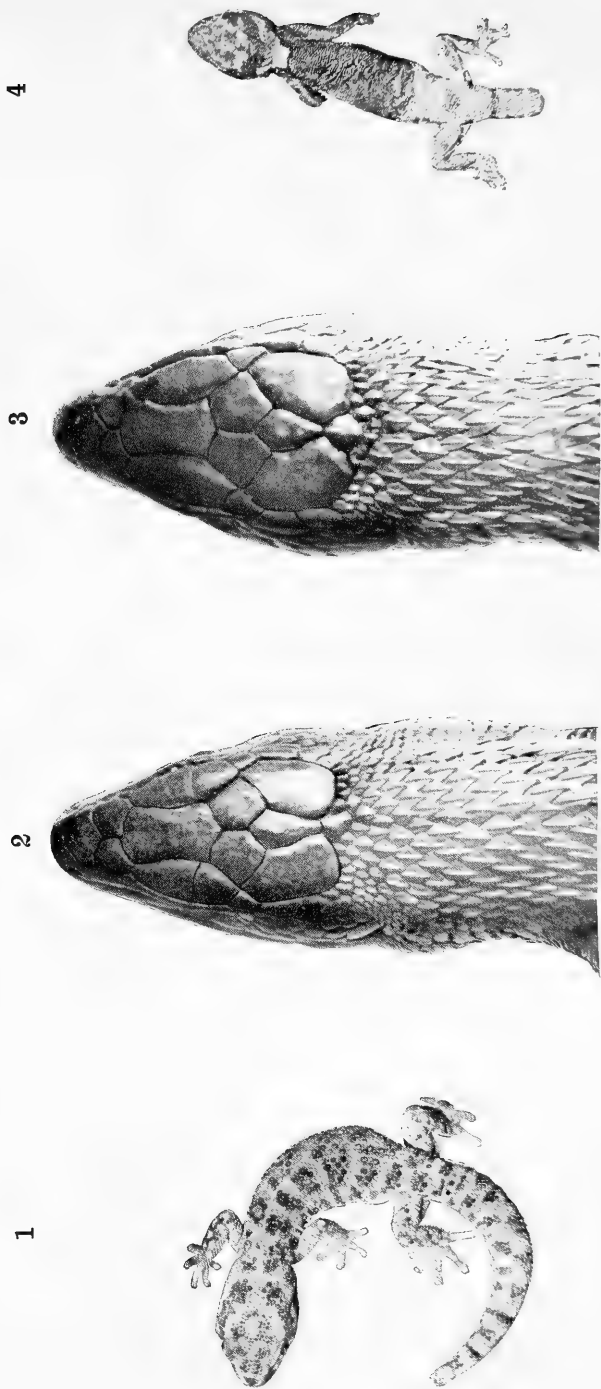
PLATE XLIV.

FIG.

1. *Pachydactylus mentalis* sp. nov. Type specimen a little enlarged.
2. *Tropidosaura montana*. Head and neck of specimen from George, C.P., enlarged.
3. *Tropidosaura montana rangeri* subsp. nov. Head and neck of type, enlarged.
4. *Pachydactylus punctatus bicolor* subsp. nov. Type specimen, a little enlarged.

PLATE XLV.

1. *Eremias burchelli quinquevittata* subsp. nov. Young male, enlarged.
2. " " " subsp. nov. Type, female.
3. *Lacerta australis* sp. nov. Type specimen, enlarged.
4. *Eremias burchelli quinquevittata* subsp. nov. Adult male, enlarged.



SOUTH AFRICAN LACERTILIA.



SOUTH AFRICAN LACERTILIA.

15. *Some Notes on the Lizards of the Cape Peninsula.*

By WALTER ROSE.

SOME personal observations of the Lizards of the Cape Peninsula are summarised in the following notes.

Notes of occurrence and frequency relate only to the Cape Peninsula, which has been fairly systematically searched. To Robben Island only two brief visits have been paid. The measurements given are those of the largest specimens collected.

Phyllodactylus porphyreus (Daud.) is very common on many parts of the mountains and on Robben Island. One specimen had a distinct vertebral stripe. Eggs, $10\frac{1}{2} \times 8$ mm., are deposited under stones at intervals, several females often sharing the same "nest." Under one stone twenty eggs were found. As a rule the young, $1\frac{1}{4}$ – $1\frac{1}{2}$ inches in length, emerge during February, covered with a thin white membrane which gradually sloughs away piecemeal. In this gecko the tail-relinquishing faculty appears to have reached its acme. Length $3\frac{1}{2}$ inches, half of which is tail.

Pachydactylus ocellatus (Cuv.) is sometimes found on the mountains associated with the above, but appears to be rare. On Robben Island near the shore are numerous small heaps of fist-sized stones, and in these this gecko may be found in large numbers, closely associated with *Zonurus cordylus*, *Phyllodactylus porphyreus*, and an occasional *Acontias meleagris*. *P. ocellatus* is far less depressed than *Ph. porphyreus*, and has a habit of standing on stiffened fore-limbs with the head raised on an almost vertical neck, and is also prone to curl up the rounded velvety body after the manner of a cat. The tail is unusually fat and undoubtedly forms a reserve of nutriment for lean times. The eye is large and limpid. The eggs are $9\frac{1}{2} \times 7$ mm. Length 3 inches, of which $1\frac{1}{2}$ is tail.

Agama atra (Daud.) is common on rocky parts of the Peninsula, from the highest peaks to the sea-level. Similar in habits and habitat to *Z. cordylus*. Leathery-cased white eggs, 15×12 mm., seven or eight in number, are deposited, October to April, in a hole about 5 inches deep, scratched by the female on the sunny side of a boulder. It

was observed that the male remained close at hand during the operation, taking a great interest therein, and apparently acting as a decoy, his brighter colouring rendering him a far more conspicuous object than his stone-coloured mate. Either from reliance on this immunity or from the engrossing nature of her occupation, the latter was only temporarily diverted therefrom by close observation from a distance of less than 2 feet. Length, body $3\frac{1}{4}$ inches, tail $4\frac{1}{4}$ inches.

Agama hispida (Linn.) appears to be confined to the sandy lowlands and is not at all common, the writer's observation being of one specimen only from Goodwood. It is said to frequent vineyards, and is far less agile than *A. atra* and less prone to bite. The tail is proportionately shorter, accounting for 3 inches of a total length of $6\frac{1}{2}$ inches.

Zonurus cordylus (Linn.) might with advantage be divided into two varieties, *niger* and *flavus*. It is very common on the mountains amongst rocks, in the clefts of which it hides. Of many hundreds seen, all have been black except for a few yellow-brown ones on Lion's Head, where the types appear to be equally represented. On Robben Island yellow-brown ones are extremely numerous in the stone heaps, associated as referred to above, but no black ones were seen. The young, usually a single one, is born alive, and 3 inches in length. Dorsally, the young of *niger* are a uniform black; those of *flavus* are sprinkled with white dots. A considerable pull is required to detach the tail, the armoured nature thereof being probably the balancing factor. In captivity *Zonurus* feeds readily on small locusts, and one was seen to devour a small *Mabuia*. Length, body $3\frac{1}{4}$ inches, tail 4 inches.

Pseudocordylus microlepidotus (Cuv.). This splendid lizard appears to be rare and confined to the steeper crags, from the deep clefts of which it can only be secured by a noose at the end of a long wire. In captivity it becomes moderately docile. Length 11 inches, of which the tail accounts for $6\frac{1}{4}$ inches.

Mabuia trivittata (Cuv.) is very common on the Cape Flats and moderately so on the mountain. The young, eight to ten in number, and measuring $2\frac{1}{2}$ inches, are born in February. This lizard becomes very docile in captivity, feeding on locusts. Length of body 4 inches, of tail 6 inches.

Mabuia homalocephala * (Wiegman), though held to be strictly rupicolous, is far more common on the sandy dunes of the Flats than on the mountain, being especially numerous between Muizenberg and

* See Hewitt, preceding paper, p. 474.

Zeekoe Vlei. The sharp nose, smooth scaling, streamline contour, and behaviour when pursued, strongly suggest that the typical habitat of *homalocephala* is in sandy regions, and its natural retreat underground. Its favourite haunt is under a small bush, from which it makes rapid sorties to secure the small locusts which are its main diet. Length $8\frac{1}{2}$ inches, of which the body is $3\frac{1}{4}$.

Scaptira knoxii (M.-Edw.) is very plentiful on the dunes and sandy uplands. In the very young the dorsal markings have the appearance of stripes. The body accounts for only 2 of the 5 inches of total length. A gravid female, taken 24th January, was found to contain three leathery eggs, 13×8 mm., which showed no sign of incubation.

Tropidosaura montana (Dum. & Bibr.) is occasionally found on the mountain slopes, and resembles *M. trivittata* in habits. Body 2 inches, tail 3 inches.

Tetradactylus seps (Linn.). Moderately common on mountain and Flats. Movements quick and decidedly serpentine, the feet at times appear to play only a minor part in locomotion. Length 7 inches, of which the tail constitutes just under 5 inches.

Tetradactylus tetradactylus (Lacép.). One from Lion's Head, four from grassy mountain slopes above Hout Bay. Exceedingly quick and hard to catch, locomotion being entirely serpentine. Only in the slowest movements can the tiny legs be of any use. Length 16 inches, of which no less than 13 inches is tail.

Chamaesaura anguina (Linn.). Several from Schoonster's Drift, others from Muizenberg Plateau, where it is very numerous in the long grass. The four or five young, 6 inches long, are born in February. It is second only to the last named in agility and elusiveness. No use of the limbs has been noted even in the slowest movements, the anterior half of the body being as a rule raised clear of the ground. Length 20 inches, the tail being 75 per cent. of this.

Scelotes bipes (Linn.) may be found under stones on the hillsides or burrowing in the sand on the Flats; also on Robben Island. In soft sand it is extremely elusive, disappearing as rapidly as if in a liquid element. Length $5\frac{1}{2}$ inches, of which the tail constitutes $2\frac{1}{2}$ inches. Two young, $2\frac{1}{2}$ inches long, born in March.

Acontias meleagris (Linn.) is found in the same localities and under the same conditions as the last, but is far stiffer in nature and less agile in its movements. Locomotion is serpentine, retiral being facilitated by a recurving of the hard tail-tip. Whilst many specimens are a uniform semi-translucent amber colour with rows of diamond-shaped black spots dorsally, in others these spots have coalesced, giving a

continuous purple-black coloration to the whole upper part. Length 10 inches, 80 per cent. of which is body.

Lophosaura pumilis, Daud., is very common on bushes and often found on reeds and grass stalks. The young, about 10 in number and $1\frac{1}{2}$ inches long, are born near Christmas, the process lasting upwards of an hour. Each infant is deposited on a branch, to which it adheres by the sticky transparent envelope in which it is encased. Within a minute it ruptures this envelope and emerges, active and able to climb with agility. Length just over 6 inches, half of this being tail.

The following have also been recorded from the Cape Peninsula, but so far have not come within the writer's observation, and it is possible that some at least are accidental importees. In each case the collector's name is given in square brackets. *Pachydactylus bibroni*, Smith [R. Smith]; *Pachydactylus maculatus*, Smith [French]; *Rhoptropus ocellatus*, Bouleng. [Layard]; *Zonurus polyzonus*, Smith [French]; *Gerrhosaurus flavigularis*, Wiegman. [De Souza]; *Mabuia sulcata*, Peters [Layard]; *Lophosaura ventralis*, Gray [Butler].

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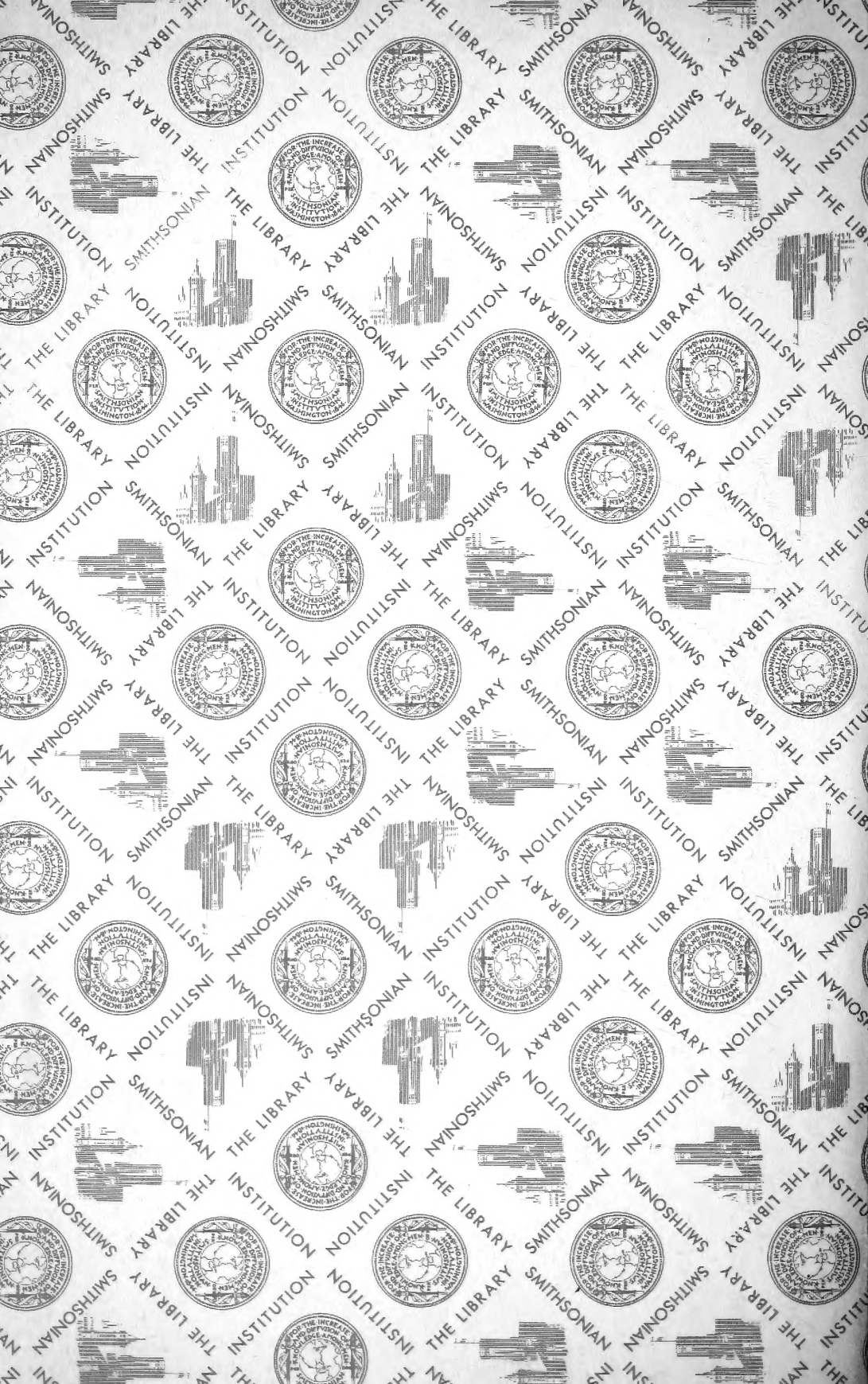
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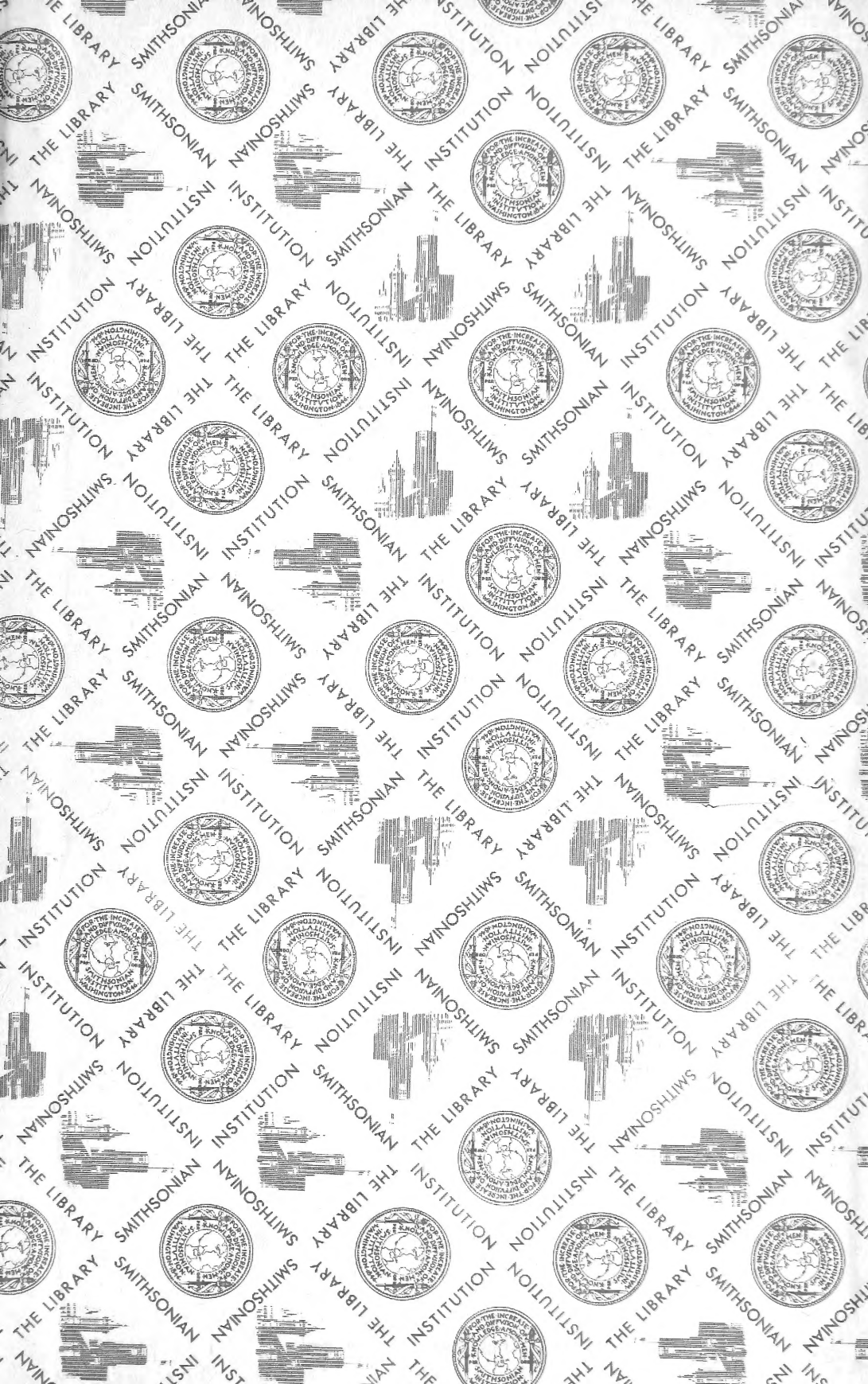
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